THE NEW BASIS OF GEOGRAPHY

A MANUAL FOR THE PREPARATION OF THE TEACHER

BY

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The waste of the old land is the material of the new. — HUTTON.

That education is best which gives one the power to select his environment and adapt himself to it.

Upheaval has raised the rough block of marble, but erosion has carved that block into the graceful statue. — GEIKIE.

Knowledge comes, but wisdom lingers. — TENNYSON.

PREFACE

WITHIN a certain pigeon-hole of my letter file there is an interesting collection of letters, including among the writers several teachers, a well-known traveller and author, an officer of the navy, a college president, and a prominent business man. Most of the letters are purely of an inquiring turn, but in some of them a suggestion of "see here, you" is apparent. The purport of each is a query about the alleged newness which popular usage is connecting with the science of geography.

Now I should like uncommonly well to know something definite about it myself, but after a thorough research I fail to find that the earth is either more or less "round like a ball or an orange" than when, some forty odd years ago, I learned to sing the capitals of the states to a birch-bark accompaniment. According to Mr. Milton:

> ". . . a gryphon through the wilderness,
> With winged course o'er hill or moory dale,
> Pursues the Arimaspian, who by stealth
> Had from his wakeful custody purloined
> The guarded gold."

The gryphons and one-eyed Arimaspians have disappeared — leaving their employment as a legacy to very persevering successors — but their loss seems to have

been offset by certain positive gains, the discoveries of one Miss Alice, whose last name has slipped my memory; and, so far as I can learn, the newness in the science of geography might very properly begin and end with these doings.

That a different interpretation of the nature and scope of geography is growing into the educational systems of the United States cannot be denied. But however new it may be in this country, both the idea and its application have been fundamental in the German educational system for more than two generations. Broadly stated, this interpretation, or "newness," is the mutual relation of geographic environment to political history on the one hand and economic development on the other. That this educational aspect of the subject should possess anything of novelty about it is not creditable to the educational institutions that have trained the teachers of the country; yet the very use of the term is a self-confession of culpability.

This book is intended to set forth in an elementary manner the relations between human activities and geographic environment. It is intended, not for a class-room manual, but for the preparation of the teacher in the educational side of geography. For matters concerning class-room devices, the reader must go elsewhere. Methods of presentation come logically after a knowledge of the subject has been acquired, and they are a highly necessary equipment of the teacher, but the discussion of them forms no part of the scope of this book.

J. W. R.

NEW YORK, January 1, 1901.

EDITOR'S INTRODUCTION

There is an unconscious assumption, on the part of those who see little or nothing to change in the subjects of study as ordinarily taught in the elementary school, that the usual curriculum is the matured result of patient thought and of careful adaptation of means to ends. There are no facts to justify any such assumption. The usual elementary school course of study is the outcome of a very haphazard and unreflecting evolution in which purely practical, not theoretical, considerations have governed. From the time of the seven liberal arts to the present day those subjects have been most taught which were themselves most useful; and usefulness has been broadly interpreted by one generation after another. It is significant to take notice how conservative the course of study has always been, and how ready it is to resist the intrusion of a new member. Latin was almost as much disturbed at the entrance of Greek some four hundred years ago, as Greek lately professed to be when the modern European languages and the natural sciences appeared at the threshold of the schoolroom. An

entrance to the course of study must, then, be forced by any new-comer, no matter what are his psychological credentials or how lofty his pretensions.

In our time this conservatism is perhaps well, although a generation of children is suffering from inadequate manual training and from most casual and imperfect science teaching because of it. But when partisanship in various causes runs so high, and when the disposition to seize upon the school to exploit some favorite panacea is so strong, the sceptical and antagonistic attitude toward novelty is the safer one. Were it otherwise, the schools would long since have been abandoned to *'isms* and *'ologies* without number.

This same conservative tendency operates, although in lesser degree, to check attempts to recast methods of schoolroom procedure and to rearrange and, so to say, to reconceive the material of instruction. A ruling method is a hard and narrow master, and in its hands education rapidly becomes pedagoguery. Nevertheless, the past twenty years have seen the teaching of elementary English revolutionized in American schools, and a similar revolution in the teaching of history and of geography has begun. The accomplished author of the present volume has planned it to serve as an influential factor in recasting geographical instruction in this country by bringing it abreast of contemporary scholarship.

The conception of geography that is here presented

seems to me to be the only one which can support its claim to a large share of the time and thought of the elementary school — that is the conception of it as a subject which relates the sciences of nature and the sciences of man. As a bridge over which to pass backward and forward from the study of man's habitat to his activities and his limitations, and back again, geography is a unique and indispensable element of an elementary education. So treated it is excelled in suggestiveness by none of its companion studies.

It is sometimes held to be a reproach to geography that it is a complex and composite subject made up of some geology, some astronomy, some physics, some mechanics, some history, some economics, and something of a dozen more sciences. In my view this very compositeness and complexity are its main source of strength as an educational instrument. It combines, relates, compares, and interprets a great mass of facts which bear upon the supremely interesting subject of man and his home. It arouses, informs, and stimulates the mind in an hundred ways, and justifies itself at every turn. But to accomplish this, geography must not be wholly identified with physiography, nor must political geography and its myriad details unduly oppress the student. Man and nature, man in nature, not man alone or nature alone, are the true subjects of interest and of study in geography. So presented, it lays the basis for systematic study of the descriptive

sciences on the one hand and of man's political and economic development on the other. It is a veritable unifying force in the subject matter of elementary instruction.

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COLUMBIA UNIVERSITY, New York,
April 15, 1901.

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INTRODUCTORY

HUMAN passions swaying the hearts of great multitudes do not always produce far-reaching or even lasting results. Without concert of action or unity of purpose, the effect is not unlike that of wild birds in confinement, beating their wings against the bars that restrain them: there is no tangible result beyond the hopeless waste of vital power; they accomplish nothing. But when those same passions are organized with intelligence and concentrated on a single purpose, when the lines of energy converge to a common focus, then the momentum becomes irresistible.

The movements of intellectual and social growth we are wont to call human progress seldom proceed evenly and smoothly; almost always there are periods of quiescence that alternate with those of unrest and increasing strain. At last the restraining bonds are overcome, and there follows what is insipidly called revolution, but which really is an irresistible expansion. Such movements are very much like the downward flow of storm waters. Finding their prog-

ress checked, their kinetic energy, little by little, is transformed into potential energy: there is friction; there is tension; the restraining barriers are burst; and the dormant forces so long held in check become the energy of motion and intense action.

So, too, the great stream of humanity has ever moved. The intellectual development for a time may be apparently restrained; for a time the pent-up energy of a people may seem dormant, but it is sleeping in appearance only. All the time it is growing in volume and increasing in intensity, until finally the bonds are burst and it expands to normal limits. The bolts and bars of prisons cannot hold it back; castle walls crumble and disappear before its mystical influence; armored battleships cannot resist its momentum; it enters impregnable fortresses and undermines the foundations of the king's palace. And the result is ever the same — expansion. The human mind grows; it expands by fits and starts, perhaps — but it expands.

History is full of the great movements of humanity that have followed outbursts of intellectual development — indeed it is these same movements that constitute history. And no matter what may seem to be the intermediate cause, the real motive may be traced always to the same incentive — geographic environment. The story of physical life, including incidentally that of mankind, is circumscribed, and is contained within the story of the earth. The external

habiliments of life are products of the earth, and when life departs they return again to the earth. At that mysterious gift of the Creator we may marvel, but we cannot fathom it, nor can we solve it. Only during the brief time in which it is chained to the earth can we know anything of it, and even then we can see only the external form that it controls. Physical life is satisfied or dissatisfied accordingly as its support is harmoniously or discordantly yielded. Change the conditions of its environment, and the external counterpart changes in obedience, adapting itself within certain limits to the new surroundings. Cut off the nutrition altogether, and the animate form disappears from the scene, to reappear, perhaps, elsewhere in new or changed form.

In human history, as in that of the lower forms, the problems of life and its conditions are merciless. Conquest, migration, the lust for power, and the acquisition of wealth, all have the same motive as an incentive — namely, hunger. Nationalism and government both point to the same objective — mutual protection and the equitable distribution of food-stuffs. But the food-stuffs come from the earth, and sooner or later, therefore, about all the activities, both of the individual and of the nation as well, revert to questions of geographic environment. Practically, about every great movement of peoples has resulted from a disturbance of environment. The immediate and apparent cause may be conquest: it may be flimsily

veiled in the name of religion, or it may be a commercial awakening; but it is always a disturbance of geographic surroundings. In the spreading out of Greek peoples in times past, and of English peoples to-day, we may see striking illustrations. There came first the discovery that they were outgrowing their circumscribing boundaries; then individual energies gradually accumulated, until they became a general impulse; finally, by virtue of migration, or by the conquest of new lands, new conditions of environment obtained. In the adjustment of a people to their new or their changed conditions, a great deal of friction develops, and the friction thus becoming manifest constitutes an important phase of history.

The great historic movements that have resulted from disturbance of environment are many in number; but at least two of them stand out in bold relief as epochs in the development of civilization, and milestones in the path of human progress. The Siege of Troy set in motion a chain of events that not only brought about the intellectual development of Aryan peoples, but in the end also carried Aryan civilization clear around the world. Perhaps the exciting cause may belong to the Age of the Myth, but the effects are none the less real and tangible. The Hellenization of Europe is a story of unnumbered struggles, almost always emphasized by blood, it is true; but it is also a story of intellectual expansion, and of the

growth of education and liberty. Mr. Gladstone's assertion that modern civilization begins with the "Iliad" is something more than a visionary fancy; it is an established truth.

When the Turks blockaded the trade routes between Europe and Cathay, there resulted another great movement that constitutes an epoch of progress wonderfully prolific in events. The discovery of a new world and the regeneration of the old are outgrowths of this apparently trivial movement. The decay of monarchical government and the rise of democracy are its offspring. It caused the demolition of the feudal castle, and upon the dismantled walls of the latter were set the corner-stones of modern commerce. The electric motor, the telegraph, the telephone, the railway, the steam engine, and all the equipments of domestic and mechanical science are its children. Modern geography in its broadest sense has resulted; and the world which five centuries ago was laid open to the search-light of discovery, is now receiving the final touches of adjustment.

That the period which has elapsed since the opening up of the new world began has been one in which war and revolution have been the rule rather than the exception, must be granted. Given that it has been an epoch, too, in which might has been the fundamental law of right, it has also been one in which the conquerors have carried with them the arts of peace and the fruits of civilization. The substitution of machinery

for the labor of the hand gave to the laborer his first chance for betterment. The mind which controls the machine is on a plane distinctly higher than that which controls merely the labor of the hand. Commerce, no matter what the aim, has always worked toward the betterment of mankind. It moves along lines of least resistance — and these are always geographic — and it has invariably encouraged education and science. To a greater extent than any other factor, it has been the vehicle by which Christianity and enlightenment have been spread broadcast over the earth.

War has its horrors, but it is less horrible than ignorance. War is a great civilizer. The tremendous energy developed in its progress is not checked either by victory or by defeat. Energy may be transformed, but it cannot be annihilated. Like the subtle electricity which seemingly disappears only to reappear in the form of heat, light, magnetism, or motion, so the energy of action or of passion aroused by war is transformed into the energy of intellectual growth and education. Moreover, in a contest between civilization and savagery, the latter has no inherent rights, save existence under such conditions as will ultimately lead to civilization. The world each year is growing smaller and smaller, when measured by the growing standards of human energy, and the adjustment, which in the nineteenth century may have appeared a passing fancy, in the twentieth becomes an absolute necessity.

CHAPTER I

The Genesis of Geography

Tradition relates that more than three thousand years ago Cadmus carried an alphabet from Phœnicia to Greece. Just what literal interpretation may be put upon the tradition cannot with certainty be stated. Using proper methods of analysis, however, it seems fairly certain that in very early times a number of conventional signs to represent vocal sounds found a resting-place among Hellenic peoples. It seems certain, too, that the alphabet evolved from pictographs or from hieroglyphs. Possibly it may have originated among the Phœnicians, but there is strong evidence that Egypt and not Phœnicia was its birthplace.

In its new home, however, great effects were to follow so soon as the process of transplanting should be accomplished. At that time the Greek tribes were scarcely a remove from barbarism in their social conditions, but they were ripe for an intellectual development that should be unsurpassed in history. The newly acquired mechanism of expression became a tremendous engine of power, and the intellectual development that was born of it marked the beginning of a new era of human thought. The deeds of valor that made the

heroic age, as a rule, appealed to the better nature of mankind; and when, finally, they were recorded in literature, they were to become as immortal as the soul of man. The fall of Troy added fresh fuel and intensified the energy of intellectual growth, and when, at last, that energy had been transformed and had crystallized, there was a new civilization in the world.

As far back as seven hundred years before the Christian era, Hellenic influences were paramount along the European and Asian shores of the Mediterranean. With the multitude of ports and trading posts wedged in among non-Hellenic and often hostile people, Greece had become practically a country without borders. At Saguntum and elsewhere along the Spanish Peninsula, in southern Italy, at the mouth of the Rhone, and all along the Ægean Sea the Greek merchant was the dominant force. And whether we find him at Marseilles or at Trebizond, at Sinope or at Corsica, along the watershed of the Don or under the shadows of the Caucasus, he is always Hellenic. The man will usually rise superior to his environment; therefore, in studying those causes that have exercised such a vast influence upon the world, one must look to the man and his social and political institutions — his language, religion, and philosophy; for it is in these only that one finds organization and unity. The Greece of geography is Ἑλλὰς σποραδικῆ — a scattered rather than a concentrated people.

Granted that the real life of the Greek may have been one from which the student turns in disgust, the ideal life, on the other hand, presents a high standard that is a heritage for all time. Any system of ethics and literature that lifts a people from a lower to a higher plane of civilization is bound to be good. Hero-worship is a corner-stone of patriotism as well as of individual character, and the heroic age of the Greeks is a treasure-house of the best examples. It would have been wisdom had both Greeks and Latins kept them always in sight.

The peculiar development of the Greeks was due partly to their conditions of geographic environment and partly to their religion. The rugged surface of their country — less than one-third is even now productive — did not favor concentration of energy or unity of government. Each range or ridge, on the contrary, was a barrier to intercommunication, and served to isolate rather than to draw the various peoples toward federation. The sea was the only great highway, and following the line of least resistance,[1] the various peoples were scattered rather than united. There was a Greek *nation* only when all Hellas met at the celebration of the Olympian games, or when any descendant of Hellas sought the common shrine at Delphos.

[1] Horace terms the sea as *dissociabilis;* Homer calls it *ὑγρά κέλευθα*, the highway of nations. But Horace lived among people who were not sailors, while Homer sprang from a race of born sailors.

To the tendency of dispersion there came about the rise and growth of another great power on the shores of the Mediterranean. Legendary history tells us that when Hekuba, queen of Troy, was heavy with child, she dreamed that she brought forth a flaming torch. Little wot she that the torch should kindle such a tremendous conflagration; for when Paris awarded the Apple of Discord to Aphrodite, in an instant his own destiny and that of the world was decided. The rape of Helene, the Siege of Troy, the fall of the beleaguered city, and the flight of Æneas follow in succession, as the wily machinations of the gods had planned. Æneas, storm-beaten in body as well as in mind, finds refuge in Italy, where he and his followers amalgamate with the people of Latium. So the legendary stories read; and sifting the facts from the imaginary and poetic, it is probable that a shipload of Greek outlaws settled in that part of Italy where their past history and pedigree would not likely be a subject of minute inquiry. Intermarrying with a people also of Aryan descent, possibly, like the Gauls, of Keltic origin, but certainly more remote, there grew up at Alba Longa a municipality of sturdy pastoral people. In the course of time it became necessary to establish an outpost near the mouth of the Tiber. The outpost itself grew into a municipality, and it is not hard to imagine it a crowd so motley that one might liken it to a Sunday concourse at Coney Island. Ramnians, Vol-

scians, Umbrians, Sabines, Etrurians, and Græco-Latins — about everything that a drag-net could gather from the slums of all Italy — gathered there. The Græco-Latins were the saving clause — the redeeming feature. They gave to the new municipality two very necessary things — organization and religion. The organization was constitutional government; the religion, obedience to duty.

The municipality soon became a kingdom, and so remained for a little more than two centuries. A wave of popular reform spreading along the Mediterranean, however, resulted in the expulsion of the tyrants from Greece and the kings from Italy. From this moment the real history of Rome begins. The growth and development of the republic was the marvel of the times. A normal territorial expansion brought the peninsula of Italy under Roman domain, and a series of foreign wars gave the republic control of the entire shores of the Mediterranean — "the great circle of the lands."

That the commerce of the sea and its basin should gradually centre about the Italian coast — mainly at the city of Rome — was wholly in accordance with geographic laws. The abundance of food-producing land and the great extent of cattle range not only invited a dense population, but supported the people as well. The dense population, together with the enormous domestic trade, produced an effect that

could not have occurred under any but the most enlightened monarchical form of government — namely, the development of an intricate system of constitutional law. Hekuba's firebrand was burning well, but the conflagration was confined only to the great circle of the lands. When the confines of the Roman republic had reached the foot of the Alps, there was an end to the first act of the movement that was to create a new civilization.

The republic had reached a period in its history when expansion to the northward had become a necessity. That it had not enlarged its domains in this direction before was due mainly to geographic causes. Expansion is apt to follow lines of least resistance, and the transalpine Gauls, therefore, were for a long time secure in their stronghold; so, too, were the Germanic peoples who held the northwestern part of Europe. Of all the peoples of Europe, the latter were the fiercest and most warlike. Angle, Saxon, Jute, Dane, Norse, and German we call them — they were emerging from barbarism to one of the lower planes of civilization, but their descendants are the dominating race of the world to-day. Along the coast they were pirates and sea-robbers; within the maritime border they were herders who much preferred to raid upon the flocks and herds of one another, rather than to care for their own property. In population they outnumbered the Romans and the rest of Southern Europe. There were some great

centres of population, and probably a number of large cities, if one can so designate great collections of mud hovels. They were not wholly without literature, but the fragments that survive show that lust, gluttony, murder, and robbery were among the gentlest of their characteristics.

It was against these people that the Roman arms were turned, and it is only a matter of justice to them to say that, although defeated, they were never conquered. The conquest of Germanic Europe was much like the coiling of a spring; while the retaining force is present there is no action, but once let the retaining force be removed, the energy becomes the energy of motion. Four hundred years of Roman occupation produced an effect, however. The invaded people were apt scholars, and they learned not only the science of war, but also the arts of peace from their invaders. And the fierce, barbarous tribes were the aptest of scholars, too, for they surpassed their teachers, leaving the latter far in the rear. By the process of education Greek ethics and art, together with Roman constitutional law, became the legacy of Germanic Europe. Of far greater importance, however, was the christianization of all Europe. The practice of self-conduct, based upon the attribute of love in its broadest sense, was a fit supplement with which to round out the education derived from the Greeks and the Romans. It was the fortuitous combination of the moral, the intellectual, and the ethical — the good, the

true, and the beautiful — the elements that go to make up character. Aryan civilization, moving with not a little friction, had accomplished two great results: it had developed a great geographic empire in the south of Europe, and it had Latinized all Germanic Europe. When the Western Roman Empire fell to pieces, there was no crash and no catastrophic results — nothing but the bursting of shackles that were preventing geographic expansion. For the next thousand years Western Europe was adjusting itself to its new environment.

Let us turn for a moment to the Græco-Roman ideas of the world's geography. In the time of the Siege of Troy, about all that was known of the earth's surface to the Greeks consisted of the shores of the Greek Peninsula and Asia Minor — the coast of the Ægean Sea. Homer, it is true, speaks of Egypt, but by this term he means only the Nile delta. The wanderings of Ulysses, as related in the "Odyssey," reveal practically nothing, even under the very liberal interpretation that the voyages and adventures were real. Although the Egyptians were skilled in astronomy, they have given us very little information of their ideas of geography and, indeed, they seemed to have heeded but little beyond the Nile. Moreover, the Egypt of earlier history refers almost wholly to the flood-plain and the delta of that river. In the canals connecting the Red and Mediterranean seas, we get a glimpse of Egyptian trade, and it is highly probable that a considerable part of Eastern Africa was

known to the Egyptians. The Phœnicians certainly were acquainted with a large part of this grand division, but there is now no record of what they knew about it. To the Greek merchants and sailors the world was even smaller. Beyond the immediate coast of the eastern Mediterranean and its islands, but little was known; the lands stretched away in the distance until they reached the shores of the river Oceanus.

In the time of Herodotus, however, the field of knowledge had grown considerably, and the geographic horizon was much more clearly defined. Not only was Herodotus a historian, but he also deserves a place, and a high one at that, among geographers. For twenty years he was a most perseverant traveller, and it is very evident that he travelled with his eyes wide open. His travels covered the distance from western Italy to Susa, the capital of the Persian Empire, and from the mouth of the Dnieper far into Africa. Although not wholly free from error, Herodotus is about the first writer of his times to separate the mythical from the real. He is among the first to recognize the existence of the three great masses of land that constitute the Eastern continent, and his statements concerning their size, shape, and relative position are not more erroneous than were the ideas of the American continent one hundred years after its discovery.

Eratosthenes rarely receives the credit that is due him as a geographer, yet he deserves an eminent place. He was not a traveller, but he assiduously collected

and edited the knowledge gained by others. In view of the unbelief in the theory of the earth's spherical shape for more than a thousand years after the Christian era, it seems singular to learn that this theory was accepted by Greek scholars nearly three hundred years before Christ. Eratosthenes not only calculated the circumference of the earth, fixing it at 25,200 geographical miles, but he also observed the inclination of the earth's axis, giving it the very close value of $23° 51'$.

Probably the greatest work ever undertaken in early times was that of Strabo, who in seventeen volumes gives a general geography of each country of the earth as it was known at the end of the Augustan age. Making a liberal use of the mathematical works of Eratosthenes, Hipparchus, and Posidonius, — the last the probable discoverer of the moon's effect on the tides, — Strabo was the first to compile a scholarly treatise on the fundamental laws of geography. He was the first to emphasize the planetary features of climate, and he elaborated the idea, probably first advanced by Hipparchus, that the earth's surface is naturally divided into five zones. Incidentally it may be mentioned, that not until nearly two thousand years after Strabo's time did it occur to geographers that the zones of light were one thing and the zones of heat quite another.

Like Herodotus, Strabo was a great traveller, and

like him, too, he possessed keen powers of observation. His chorography is certainly the best up to the time in which he lived. Africa excepted, his outlines of the Eastern continent are fairly good, though he evidently clings to the old Greek idea that the land is twice as long as it is broad. His ideas of Western Europe were clear, and he censured Eratosthenes for believing in the existence of Thule,[1] holding Ireland to be the most northerly part of Britain.

The conquest of Alexander the Great had opened the way between Europe and Asia, and in the course of time a steady stream of commerce began to flow between the Orient and the Occident. The breaking up of the Western Roman Empire was somewhat of a check upon it, but during the Crusades it had grown to vast proportions, centring mainly at Genoa and Venice. Heavily laden caravels from the Adriatic, carrying their cargoes of woollen and linen cloths,

[1] The land called Thule was brought to public notice by Pytheas of Massilia (about 275 B.C.), who affirmed it to be six days north of Britain, and in a latitude in which the June days were twenty-four hours long. In this region he stated that there was no distinction between earth, air, and sea, but that everything was in the form of a gelatinous substance. This substance he claimed to have seen, but the rest he derived from hearsay. In the time of Agricola Roman sailors had sailed around Britain and touched at the Orkney Islands, claiming to have seen Thule to the northward — doubtless the Shetland Islands. There is no means of identifying the Thule of Pytheas. It may have been either Iceland or Greenland, and the "gelatinous substance" may have been sludge ice — all of which is a matter of speculation. Eratosthenes *may* have been right, but Strabo certainly was wrong.

glass ware, metal goods, and wine, fetched silk, cotton, cashmere, ivory, perfumes, spices, and gems brought from India, Arabia, and Africa. Genoese merchants, following different routes, brought their merchandise up the Euphrates from the Persian Gulf, a route that in former times had made Palmyra a great trade mart. Another route lay up the Indus, across to the Amu Darya, or Oxus, thence across the Caspian and along the Black Sea to Constantinople. Even as far back as the third century, China — under the name of Serica, or of Thin[1] — had become known because of its silks, and there was vague knowledge of Zipango, or Japan, and Taprobane, or Ceylon. There was no direct communication between Europe and China, however; all the silk stuffs so highly prized by the wealthy Europeans passed through many hands.

That the growth and development of this commerce should steadily increase, in spite of wars and the heavy restrictions placed on trade, at first seems strange, until one recollects that, after the breaking up of the Roman Empire, it was much easier for a sovereign to obtain wealth by pillaging his own subjects rather than to depend upon the very uncertain profits in plundering a foreign people. In a way, the despised merchant, especially if he were a Jew, became a necessary evil —

[1] Seres or Serica was the name given by the silk merchants; Thin, Tsin, or Sinæ by historical writers, probably from the Chin dynasty, then the ruling power.

a something to be protected until his accumulations were worth filching. So, for nearly a thousand years from the breaking up of the Western Roman Empire, a moderate degree of prosperity fell to the lot of the European merchant. In time he turned against his oppressors, and in time the feudal castle fell before the well-delivered blows of the factory hand. Learning and culture increased throughout Central Europe, and with it there came the stimulus of curiosity — the desire of knowledge concerning the Indies and China.

But almost in a twinkling this vast trade and the elaborate mechanism by which it was carried on received a crushing stroke. Hekuba's conflagration was only smothered, however; it was again to burn more fiercely than ever. The wet blanket that for a time covered the glowing pile was the invasion of the Turks. Inspired with that zeal that has ever made the teachings of Islam a religion of the fire and the sword, a horde of Turks poured forth from the deserts of Asia, and overwhelming Asia Minor, drove the Christians, and likewise European trade, out of Syria. The treacherous machinations that grew out of the mutual jealousies of Genoa and Venice made an open door into the Balkan Peninsula, and resulted in the fall of Constantinople (1453). The trade of all Europe was at the mercy of a people whose very shadow blighted everything on which it fell. Commerce was at a standstill. Turkish corsairs swept the Mediterranean; swift-

mounted rough riders guarded every route and swooped down on every luckless caravan.

What threatened also to become an equal catastrophe, occurred early in the thirteenth century, when Jenghis Khan overran the whole northern part of Asia and extended his domain almost to the Baltic Sea. But Jenghis proved to be a delightfully jolly-hearted barbarian; moreover, he was possessed of a woman's curiosity, and both he and his followers wanted to learn about everything worth knowing. So all the barriers were removed, and the former policy of seclusion gave way to one of wide-openness. Neither before nor since has China, or Cathay,[1] as it was then called, been so accessible. Then followed a century or more of the development of geographic knowledge. What the Crusades had done in enlightening Europe about itself, the invasion of Jenghis accomplished with reference to Asia. The resulting knowledge made all Europe rub its eyes with astonishment. Remote regions traditionally peopled with dragons, gryphons, dog-headed folk, and one-eyed Arimaspians gradually evolved into very respectable countries of decently behaved people,[2] having boundaries that were terrestrial rather than lunary. Late

[1] Probably from *Ki thai*, a formerly reigning Mongal dynasty.

[2] Many of the descriptions of the moie remote countries are marvels of imagination, and the school which they represent was rounded up by one Sir John Mandeville, whose "Travels," even to the present day, are a most delightful piece of imaginative fancy. The real Sir John was a Burgundian leech, who, in his younger days, had probably journeyed

in the thirteenth century the brothers Maffeo and Nicolo Polo, together with Marco, Nicolo's son, made a trading journey that covered about all of China and India. Even before the account written by Marco Polo had been published, John Pian del Carpini had carried a message from Pope Innocent IV. to the Grand Khan, at Karakorum, and following in the steps of Marco Polo, Friar Odoric reached as far eastward as Sumatra and Java. Indeed, so great was the travel, that Francesco Pegolotti,[1] a Florentine trader, wrote a "Baedeker" for the use of European travellers to Cathay.

in the capacity of notary to some ecclesiastic to the Holy Land. As a resourceful liar he is without equal in the annals of literature, and he evidently wrote with the idea that human gullibility has no bounds. Everything landed by his net was fish, and so the story of the weeping crocodile, the legend of the grains from which grew the wood of the Cross, the story of the phœnix, and the account of Prester John were all pressed into service. The first three chapters of his "Travels" are authentic and reasonably true. The remaining portions are cribbed from about everything he could get hold of. The writings and accounts of Friar Odoric, John Pian del Carpini, Hayton, William of Boldensele, and Pliny, are pretty well gutted to furnish material. The only thing to escape his notice was Marco Polo's travels, and just why he did not absorb this source of information is difficult to say. Sir John's bumptious personality and the modest way in which he unloads his most rousing whids, make the "Travels" most delightful reading. For a more extended account of the book the reader is referred to Mr. Yule's sketch in the Encyclopædia Britannica, and to the author's edition of the "Travels" published by D. Appleton & Co. in the series of The World's Great Books.

[1] Mr. John Fiske, in his "Discovery of America," notes a very important word of advice which Pegolotti imparts to the uninitiated, i., p. 291: "And don't forget that if you treat the custom officers with respect, and make them

There was one item of information brought back by travellers — first noted by Friar Odoric — that in a little time set all Europe a-thinking: they not only asserted that Cathay had on its eastern border an ocean, but several of them had coasted that ocean, so that it was known from Japan to the Red Sea. Thus, for the first time, there was positive knowledge that Asia had a definite eastern boundary, and that that boundary was an ocean. This, as Mr. John Fiske aptly remarks, became "a notable landmark in the discovery of America." The ocean was east of Asia, it was west of Europe; therefore, one might sail westward from Europe and reach India and Cathay. The idea was one of those concentrated thoughts that gathers strength as it goes. Hekuba's fires were again glowing.

something of a present in goods or money, they will behave with great civility and always be ready to appraise your wares below their real value."

CHAPTER II

THE TRADE ROUTES TO INDIA AND THE DISCOVERY OF THE NEW WORLD

WITH the only available routes to the Orient hermetically sealed, it is not strange that the thoughts of commercial Europe should be centred on finding some means of intercommunication that the Turks could not reach. That either Venice or Genoa should make any great effort was out of the question. Not only were their resources exhausted because of their fighting each other, but their sailors, for the greater part, were ignorant of the navigation of any routes but the old ones; they were fine men for Mediterranean voyages, but not for deep-water sailing. Moreover, while the ships of each State preyed upon those of the other, Turkish corsairs looted and scuttled both.

That the Portuguese and Spanish should come to the front at this time was of necessity to be expected; it was a sort of natural selection. The English, likewise, were waking up and were ready to take advantage of whatever opportunity might present itself. The Portuguese, for the very best reasons, planned their lines of search to the south and east, along the African coast. For many years they had had troubles of their

own, and the chief source of them was the Moorish pirates. The vessels of the latter were swift, and they were manned by probably the most skilful cutthroats that ever sailed the high sea. They were ubiquitous and omnipresent. As a result, the whole power of the Portuguese government was turned against them, and strong fleets patrolled the northwestern coast of Africa, convoying the returning merchantmen to ports of safety.

When the Western Roman Empire was at the height of its glory, there was a brisk trade along the west coast of Africa, but for a long time after the collapse of the empire it had been neglected, and even the knowledge of the coast, to a considerable extent, passed out of existence. Early in the fifteenth century, however, Prince Henry of Portugal, better known as the Navigator, who had learned something of the interior of Africa, received a grant from the papal throne authorizing him to acquire all lands in Africa beyond the territory of the Moors and Saracens. The lands in question were to accrue to Portugal. Possibly Prince Henry was aware that his profits were not wholly speculative. Being something of a business man as well as a sailor, he had already definite information of many of the coasts and islands once known to the Romans, but forgotten for many years afterward. Besides, he had perfected the mariner's compass, the use of which was just beginning to be known. The dis-

covery of the Azores, a hundred years before, had doubtless set him thinking, while the fact that Portuguese sailors had also reached Madeira and Cape Bojador must have been an additional stimulus. Prince Henry's thoughts certainly were worth banking on, for, in a very short time, not only had he rediscovered the coast details as far south as the latitude of Madeira, but he had rediscovered and colonized that island itself. Then he attacked the problem of Cape Bojador in a very practical way: he found it and sailed a hundred miles beyond it. Thus was another bugbear demolished, for the superstitious sailors believed to a man that no vessel could be built which would withstand the waves that lashed this storm-beaten cape. The next vessel sent out a few years later not only rounded Cape Bojador, but reached the mouth of the Rio del Oro, incidentally bringing back a rich cargo of gold and slaves.

In 1463 death snatched Prince Henry, but it did not put a stop to his work. He had already trained a large class of master mariners, and the work of exploration went on under royal direction. There was but one more bugbear of superstition to be downed; namely, the belief that the burning heat of the Torrid Zone would consume every living thing that entered it. But in 1471 Santarem and Escobar sailed along the Gold Coast and crossed the equator, while three years later Cam entered the mouth of the Kongo, and

then, surpassing his former voyage, cast anchor in Walvisch Bay. In the meantime an enormous trade grew up along the coast, which certainly did not decrease the king's exchequer. It was an era of prosperity to Portugal, and inasmuch as the proverbial bird was in the hand, his neighbor in the bush was half neglected.

Then, unheralded, there came about one of those seemingly trivial incidents that was bound to be far-reaching in its effects. The incident in question has knocked about in history, but it remained for Mr. John Fiske to give it the proper interpretation. Just after the discovery of the Kongo, a negro king of the Gold Coast sent an envoy to the king of Portugal asking that missionaries might be sent to the royal state of the former. To just what purpose the missionaries were to be put does not matter. The envoy, however, brought a story that nearly paralyzed King John with joy and excitement. It was, in effect, that a long way to the eastward of the domains of his royal master there dwelt in great splendor a powerful sovereign whose emblem was a bronze cross. Whether or not there was a private understanding between the ship's captain, party of the first part, and the envoy, party of the second part, involving a transfer of backsheesh from the former to the latter, does not concern history. Contagion never took more effectually than did this story. In it King John saw a vision of

Prester John[1] and a safe route to India all rolled into one great effect, and he fairly fell over himself to take advantage of it. He immediately fitted out an expedition, under the command of Bartholomew Dias, to find a way to the Atlantic coast of Africa; at the same time Pedro de Covilham[2] was despatched by way of the Red Sea and Egypt. Covilham finally turned up in Abyssinia, where he spent the rest of his life. Dias, after a stormy voyage, rounded the south coast of Africa, and sighted land probably in Mosel Bay, not far from the present city of Port Elizabeth. He wished to push still farther north, but his sailors rebelled, and so he turned back, discovering the Cape of Good Hope on his return.

The log-book showed a run of more than thirteen thousand miles — by far the most remarkable made before that time, unless we accept that of Leif Eric-

[1] Prester John was a mythical Christian potentate, who, in the middle of the twelfth century, was alleged to have broken the power of Islam in Western Asia, building there a great empire that extended into Africa. According to vulgar belief, he was leading an invincible army toward Jerusalem in order to annihilate the Mussulmans and reëstablish the Holy City. About the time that gossip began to wane, there appeared a letter from the artful presbyter addressed to Comnenus, Emperor of Constantinople. It was a fine piece of description, and served its purpose well. The spreading of Nestorian belief lies probably at the foundation of the myth, and the letter was a whole-cloth fabrication of a Nestorian monk. Marco Polo identifies Unk, a Tartar Khan who also bore a Christian title, as the original Prester John.

[2] Probably an English sailor, Peter Cobbleham, who, like Gil Eannes (Giles Jones), had entered the service of Prince Henry. — *Fiske.*

son. His only means of finding his place at sea was a crude form of astrolabe which he went ashore to use. When finally he turned his vessels eastward, he could not have suspected that he was beyond the southern point of Africa, for he had been out of sight of land for many days. The voyage of Dias practically settled the question of an all-water route to India. If there was any doubt in the mind of King John, a message from Covilham, in Abyssinia, seemed to settle the question. "The ships," he said, "that sail down the coast of Guinea ought to be sure of reaching the termination of the continent by persevering in a course to the south." The voyage also put an end to a growing belief, formerly advanced by Claudius Ptolemy and Hipparchus, that the continental land reached around the world,[1] enclosing the Indian Ocean. In a way, too, it brought back the old Homeric notion of an ocean that surrounded the land.[2]

In founding his school of navigation, therefore, Prince Henry builded well.

The illness and death of King John delayed further

[1] Herodotus was told that a squadron of Phœnician ships, entering the Red Sea, sailed around the coast of Africa, and finally reached home by way of the Mediterranean. He expresses his disbelief of the story, but the statement that they had the sun on the northward in rounding the Cape is an earmark of truth that cannot be lightly set aside.

[2] *τὸν δε Ὠκεανὸν λόγῳ μὲν λέγουσι ἀπ' ἡλίου ἀνατολέων αρξάμενον γῆν περὶ πᾶσαν ῥέειν, ἔργῳ δε οὐκ ἀποδεικνῦσι.*

search for the royal presbyter for some years, but in 1497 Vasco da Gama doubled the Cape, crossed the Indian Ocean, and reached the city of Calicut, on the west coast of Hindustan. Not only did he bring back a cargo of very great value, but he also established a purchasing agency there.

Long before the actual discovery of the all-water route to India, however, there grew into the minds of those most interested a vague suspicion that such a route as the one around Africa would scarcely fill the needs of the times: it was both too long and too dangerous. There was a vague belief, too, that land could be found by sailing westward. Pieces of strangely carved wood had been picked up at sea, or had drifted to European shores; the bodies of two men of unknown race had washed ashore on the island of Flores; and pine trees and bamboo stalks had also been driven by the prevailing westerlies to the islands and the mainland. Moreover, the legends of St. Brandan's Island and of Antilia, in common with similar myths, seemed to have a nucleus of truth.

Among the trained seamen that had gathered at the school of Prince Henry were two brothers, Christopher and Bartholomew Columbus. The latter was with Dias in his voyage around the Cape. The former had had a wider experience: he had sailed the Mediterranean and knew it by heart; he had spent some time on the Gold Coast, and he had visited England, Iceland, and

the Faroe Islands. Between times he studied astronomy, made sailing charts, and wrote books. Of the latter, unfortunately, there are no copies extant, but one, "The Five Habitable Zones," was intended to refute the many ridiculous notions about the all-burning Torrid and the ever frozen Frigid Zone. It has been conjectured by some, and declared by other writers, that Columbus must have learned something about Vinland and the voyages of Leif Ericson and Thorfinn while at Iceland. There has never been found the first scrap of evidence to support such a claim, however. Otherwise, "Why," as Mr. Fiske asks, "did he sedulously refrain from using the only convincing argument at his command, namely, that a continent had actually been found in the direction which he indicated?"

Among the scholars of the time whose thoughts seemed to have influenced Columbus was the famous astronomer Toscanelli. Toscanelli was something of a chorographer as well, and had completed a map that contained about all that was known of the world's outlines. The original map is unfortunately lost, but it is easily reproduced from the globe of Martin Behaim. The information gathered by the Polos had just begun to be appreciated, and Toscanelli had made a most liberal use of it. As a result, there was no little discussion among the scholars of the time about a westward route to India and Cathay. To the Spanish, a westward passage was simply a necessity for the reason

that, by the decree of the Pope, about everything east of the meridian of Ferro worth discovering had been granted to the Portuguese. Therefore the Spanish must look for hope toward the west. There was also another important question, Was the western passage shorter than that by way of the Cape? This question, from the best data that could be obtained, was answered in the affirmative. Columbus went about his determinations in this way: the circumference of the earth, according to Ptolemy, was 20,400 nautical miles (the 25,200 miles of Eratosthenes was then thought to be too great), but by measuring along the parallel of the Canaries the distance was only 18,000 miles. Taking the statement from the Fourth Book of Esdras that six parts of the earth are inhabited and only the seventh covered with water, he reasoned logically that the route to Zipangu would cover scarcely 2500 miles.

One might smile nowadays at the simple faith of the man, but it must be remembered that the period was not exactly propitious for "the higher criticism of Scripture"; and, moreover, Columbus was a man of deep religious nature.[1] This idea was not new, nor did Columbus originate it; it was held by Roger Bacon two hundred years before and received the tacit sanction of the Church.

[1] This aspect of the man is an answer sufficient to meet the railings of Signor Lombroso, who has spent unnecessary time and ink to show that Columbus was morally degenerate.

The plan had been uppermost in Columbus's mind for ten years before he broached it to King John of Portugal, just after returning from the Guinea coast. King John submitted the plans to two societies or committees, each of which pronounced against the scheme as impractical and visionary. Then as an afterthought he was persuaded into playing a very indecent trick. He fitted out a ship secretly to follow the sailing route charted by Columbus, but the crew of the vessel got a severe attack of fright before they were scarcely out of sight of the Cape Verde Islands, and skulked back to Lisbon. On learning of this piece of rascality, Columbus shook the dust of Portugal from his feet and departed for Spain. After many discouraging delays, he won the friendship and confidence of Juan Perez, Prior of La Rabida monastery, who enlisted the royal treasurers Quintanilla of Castile and Santangel of Aragon. It is sometimes alleged that the Church secretly opposed Columbus, but no untruer statement was ever made; Juan Perez, Quintanilla, Santangel, Mendoza, and the saintly Las Casas, all priests, were his warmest friends and supporters. At the time when the plan was nigh falling through for want of money, however, Queen Isabella came to the rescue and pledged her credit for a considerable part needed. For himself, Columbus demanded the office of admiral in perpetuity over all lands discovered and a royalty of one-tenth of the net profits of the enterprise, with a

further royalty of one-eighth of the profits of succeeding enterprises. At the signing of the contract Columbus made a vow to devote his share of the profits to the restoration of the Holy Sepulchre.

The preparations for the voyage were immediately begun. A caracca and two caravals were pressed into service, the first commanded by Juan de La Cosa, the caravals by the brothers Pinzon. Half an hour before sunrise August 3, 1492, the squadron weighed anchor at Palos and stood for the Canaries, stopping there long enough to repair the rudder of the *Pinta*, probably broken by the design of her timid owners who were sailors aboard the ship. Fortunately the voyage was undertaken during the season when the sea is usually free from hard weather; the course laid out was due west from the Canaries, which, according to Toscanelli's map, would take them on the arc of the 28th parallel to the northern part of Zipangu, and thence to Zaiton, or Chang Chow. From the very first Columbus understated the daily distance, keeping two reckonings, in order to allay any fears on the part of his crew, — he had declared the total distance to be run at not more than twenty-five hundred miles, — and he was prudent enough not to excite unnecessary fears. Even with all precautions the crew were frequently on the verge of mutiny; they could not understand the shifting of the compass needle as its variation changed, nor could they understand the sluggish movement of the ships as they

almost forced their way through the Sargasso Sea. After the squadron had spanned twenty-five hundred miles and over, or about twenty-two hundred according to the doctored log, Columbus began to fear that he had rounded the northern point of Zipangu, and so he shifted his course a couple of points to the south. This was October 4; by the 11th the signs of land began to be so clear that the feeling of mutiny gave way to one of excitement. That evening a light was seen on the shore, and at two on the morning of the 12th — the 21st according to the present calendar — land was sighted,[1] and the vessels hove to. Satisfied that he had reached the islands outlying Cathay,[2] Columbus spent but a few days in the Bahamas; he set sail for Zipangu — and landed on the north side of Cuba! He

[1] The island, one of the Bahama group, at which the first landfall was made, is not with certainty known; but Samana or Atwood Cay corresponds most nearly to the course followed after leaving the island, and its general form corresponds to the description in the log, namely, an east-and-west lying island. Columbus says that the native name was *Guanahani*, but he renamed it San Salvador. The map drawn by Juan de La Cosa, the master of the caracca *Santa Maria*, affords no identification of the island, and that of Herrera is equally faulty. Among the maps in the British Museum is one antedating the Herrera map by about thirty or forty years, on which the names Samana and Guanahani are both applied to the same island. For a comprehensive discussion of the subject the reader is referred to the author's "First Landfall of Columbus," *Nat. Geog. Mag.*, 1894, vol. vi, p. 179 *et seq.*

[2] Marco Polo had described the coast as studded with small islands. Columbus found "fragrance," but no spices; nor was it the last time that he got the shadow for the substance.

coasted about the island, finding not spices but tobacco. While Columbus was coasting about Cuba, the elder Pinzon deserted him, possibly with the idea of being the first to communicate the tidings. Columbus made no effort to find him, however, but contented himself with exploring the coast of Cuba and of Haiti.

With Christmas, however, there came another unpleasant mishap. The *Santa Maria* grounded near the site of Port de Paix and quickly went to pieces. The accident was too serious to be helped: there was nothing to do but to return to Spain. Leaving a part of his crew on the south coast of Haiti, he embarked with the remainder for Spain, overtaking the *Pinta* with the faithless Pinzon along the north coast of the island. After much severe weather and great hardships, the *Pinta* and *Niña* reached Palos. Columbus was summoned to Barcelona to receive the honors he so richly deserved. The few gold trinkets and pearls he brought back were scarcely an equivalent to the cost of the expedition, but they promised well for the future. Of more interest were the half dozen Caribs; and since the country they came from was India, what more natural than to call them Indians.

Columbus made three additional voyages. On the third he touched South America at the mouth of the Orinoco, and on the fourth, the coast of Central America. Then the shadows began to gather. The visions of wealth that Ferdinand had sought, failed to mate-

rialize, and so he listened to the venomous tales of Fonseca. Columbus was deprived of his office, chained, and cast into a dungeon. The beautiful character of Isabella then shone out brighter than all the splendor of Aragon and Castile. She not only interceded for Columbus, but she took upon her own shoulders the responsibility for the blame. Then the light went out of her life, and the career of Columbus was finished. He died forsaken and in poverty, and the shackles he wore in the streets of Cadiz were buried with him. And to this day no one knows his final resting-place. So ended the search for the Indies by the westward passage:[1] the completion of the discovery of America is quite another matter.

Although America and Europe were brought in touch by the discoveries of Columbus, there doubtless had been various visits to the continent, and it is probable that Chinese traders had explored its Pacific coast five hundred years before the attempt at colonization was made by the Norse. It is very unlikely that any one in Southern Europe could have known anything of the latter; that Columbus knew nothing of it is shown by the route he followed.

Late in the ninth century, five hundred years before the voyage of Columbus, there occurred a political revolution in Norway that resulted in the

[1] Cabral, a Portuguese sailor, en route to India, was carried westward to Brazil in 1500.

federation of the kingdom and the uprooting of a sort of feudalism which had come into existence. Many of the independent feudal lords, chafing under the new system, refused to brook restraint and left the peninsula. It was another case of the concentration of energy that arises from unity of thought. The lords, or Jarls, left by dozens and scores. They settled in Scotland, in Ireland, in France, and even in Constantinople. They established colonies along the Baltic, in the Orkneys, the Shetlands, the Faroes, and in Iceland. In 876 one Gunnbjörn reached Greenland, spending the winter there; and in 983 Erik the Red, who had been setting a rather too rapid pace in one of the islands, found it convenient to get away from the arm of the law; so with a number of companions set out for Greenland. After exploring both coasts pretty thoroughly, they found a level, grass-covered mesa at the head of Igaliko Fjord. As soon as Erik felt certain that he would not be molested he returned, and, visiting Iceland, induced many families to cast their lot in the new settlement. Eventually two colonies, or series of settlements, were formed, one near Godthaab, the other near Julianeshaab; the one was named Westbygd, the other Eastbygd. The two colonies prospered for a while and did not finally disappear until four hundred years later. Some of the old buildings, their stone-built walls chinked with clay, are yet standing.

In 986 Bjarn (plain Barnes), a son of one of the men who went with Erik, in returning from Iceland to Greenland, lost his reckoning, and getting into the fog finally hove to on a shore bordered by a low coast plain. So, perceiving that he was badly out of place, he turned northeast, and, in time, got safely home. Three years later, while in Norway, he told his story to Leif, the son of Erik the Red. The story had a magical effect. The inherited instincts of the father came to the surface; throwing aside his robes — he had been a clergyman — he lost no time in getting into a sailor's pea-jacket, and in the fall of 1000, with thirty-five men, put to sea. They landed somewhere along the Labrador coast — Helluland, they called it — and then turning southward reached a wooded coast which they called Markland. Thence they continued southward to an open bay or land-locked sea, where they landed near by and spent the winter. They found an abundance of wild (fox) grapes, and therefore they named the place Vinland. There has been much speculation concerning the location of Vinland, but it is hardly possible the place will ever be determined. As Mr. John Fiske suggests, it was between Point Judith and Cape Breton.

Leif returned to Greenland next spring. His two brothers each made a voyage to Vinland, using Leif's ship, but going at different times. One was

killed by Indians; the other died on the voyage. In 1006 a wealthy Icelander of noble birth became interested in the accounts of the Ericsons. This knight, Thorfinn, married the widow of one of Leif's brothers, and immediately set out for Vinland with four ships, where his son was born. For three years they remained there, cutting timber and getting furs. Then the natives became so hostile that the survivors abandoned the settlement and returned to Greenland. In 1010 there was another attempt to found a colony at Vinland, but the colonists quarrelled and murdered one another, until but four or five were left. And when they returned and the story got out, the survivors were so completely shunned that all knowledge of Vinland died with them. So ended the attempt that at first seemed so full of promise.

It is only fair to say that the whole story of the Greenland and Vinland settlements has been denied. So far as Greenland is concerned, documentary evidence is abundant, and the evidence is of the most conclusive sort: one might as well deny the Revolutionary War. Even as late as the beginning of the fifteenth century there is a record of a marriage in the old Kakortok church, whose walls are yet standing. The two colonies numbered about six thousand souls. Regarding Vinland, evidence is confined wholly to Icelandic and Norse literature. There is not a scrap

of corroborative evidence in the shape of relics[1] and ruins. If, however, the internal evidence contained in the Sagas was trumped up, then one must admit that the writers had a miraculous power to describe actually existing things which they could have neither seen nor heard about.

But the Norse expeditions and settlements, the discoveries of Columbus, the voyages of the Cabots, the fulsome work of Vespucci, who may or may not have given a name to the continent, the mishap that drove Cabral to the coast of Brazil, and the sickening results of the post-Columbian expeditions — all these were incidents in the discovery of America. Each formed a part of the work, but the discovery was not completed for a century afterward.

For twenty years or more after Columbus's first voyage no one seemed to realize just what had been discovered. The voyages of the Cabots in 1497 and 1498, and the discovery of the northeast coast of North America, had so little significance that Henry VII considered ten pounds a fair equivalent. It was merely a bit of Chinese coast, as they thought. The

[1] Mr. John Fiske is troubled because none of the early French or English explorers "ever set eyes upon wild cattle or pigs or hounds." If he knew as much of the Indian and his fondness for meat, from personal contact, as does the writer, this bugbear would quickly vanish; moreover, there could scarcely have been more than one hundred people in Vinland at any time, and the few animals they may have abandoned were quickly slaughtered.

long list of voyages along the Brazilian coast were equally unimportant. By 1502 the South American coast had been explored as far as South Georgian Island, but even then it was not suspected that the Atlantic and the Pacific came together near by. A voyage by the Portuguese navigators D'Abreu and Serrano to the Molucca Islands in 1511, and another by Andrade to China *by way of the Eastward Passage*, again began to set Europe thinking. Here was China, and the real thing, too, on the east; and here also was a broad ocean in the place of what the map of Toscanelli showed to be Asian territory. But what was still more important, in 1513 Balboa had actually crossed the newly discovered land and had found a vast ocean on its western border. So, little by little, it dawned upon those who were most interested that the new coasts were not a part of Asia, but a great continent between Europe and Asia.

The Moluccas had been reached by the eastern route; was it possible to reach them by the western route? — this was a question that occupied the thoughts of Magellan. But King Emanuel, who had a monopoly of the eastern route as a bird in the hand, was content to let well enough alone. If only the barrier of the Americas could be circumnavigated, what a chance for Spain, whose newly acquired possessions so far seemed to be a gold brick! The chance was seized, and Spain, September 20, 1519, put five ships at the command

of Magellan. From the Canaries they went down the African coast to Sierra Leone, thence to the Brazilian coast, near Pernambuco, and thence southward along the coast to Patagonia, to the strait that now bears Magellan's name. Before entering the Strait three of his captains mutinied; but trivial things of that kind did not disturb Magellan: he knifed one to the heart, beheaded a second, and put the third on a barren shore to muse on the inconvenience of being an instant too slow with his machete. One ship was sent back to Spain with her captain in irons. There was no more mutiny.

Having sailed through the Strait, October, 1520, there was a long stretch before they should again sight land — five thousand miles of hunger, starvation, misery, and death. To read Pigafetta's journal is sufficient to turn the heart of the most stoical. March 6 they reached the Ladrones and, for the first time, were able to supply themselves with decent food and good water. Ten days later the vessels, three in number, reached the Philippines, where Magellan himself was killed by the natives. Of the 280 men who had left Spain, 115 were left. One of the vessels was found unseaworthy and therefore was burned. In December the vessels reached their destination, the Moluccas. Here one vessel, much in need of repairs, was put out of commission for the time being; the other, the *Victoria*, set sail for the Cape of Good Hope, and rounding

the Cape finally reached the port from which she sailed, September 6,[1] 1522.

The voyage of Magellan is certainly the greatest feat ever recorded in the annals of history. In comparison, the voyage of Columbus was much like an October trip to Old Point Comfort. There was but one thing further to accomplish, and that was done in part by Sir Francis Drake, who surveyed the greater part of the west coast of America, 1577–1580, and by Vitus Bering, who found the strait, now bearing his name, that separates Asia from America. For a long time, too, there was a search for a northeast and also a northwest passage that should lead through the Arctic Ocean from Europe to Asia; but although the passage was found the results were futile.

In a way, the results both of the new route to India around the Cape and the discovery of America were disappointing. Venice and Genoa lost all their remaining trade—punishment they richly deserved. Portugal failed to hold any considerable part of the India trade, and Spain got none at all. In the course of two centuries, they acquired possession of the greater part of America. Both nations followed the plan of killing the goose that laid the golden egg, and, as a result, lost their possessions and gained each a war debt.

[1] It was really September 7; they had lost a day by sailing westward.

The commerce with India, as well as a tremendous home trade, was gradually transferred to the shores of the north and the Baltic Sea. The decline of the Hanseatic League, the greatest business combination ever known, was followed by the development of commerce on broader and better lines. The growth of manufacture demanded an educated people, and before such a power the barbaric structure of feudalism could not long stand. So when the smoke of battle had cleared away, the factory took shape upon the foundations of the castle, and the hum of machinery supplanted the clang of steel against armor.

The most apparent result of the blocking of the trade routes, therefore, was the industrial and commercial revolution that regenerated all Europe. Moreover, it was an adjustment along geographic lines, and the progress of history is permanent only when it advances along such lines. The greatest problem of physical life is the adaptation of the individual to the conditions of its environment, and the nation must govern itself by the observance of similar laws.

CHAPTER III

Physiographic Processes

Properly interpreted, a summary of the preceding chapters points out the fact that this great period of discovery, with its grewsome stories of peril, hardship, and disaster, all resulted because the Turks had blockaded the available routes of commercial intercourse. Man is a gregarious animal and in a high state of civilization must obtain the necessities of life, not from his immediate environment, but often from localities far remote from his dwelling-place. Thus England must look very largely to India for cotton and wheat, to Australia for gold and wool, to New Zealand and Canada for meat, and to the United States for cotton, wheat, and meat. Now the stoppage of the arteries of travel and commerce between Europe and India not only disturbed the whole mechanism of commerce, but in a way it indirectly cut off nutrition very much in the same way that the shutting down of any great manufacturing enterprise throws its thousands of employees out of work, and prevents them from earning their daily bread. In other words, because all nutrition comes from the earth, the earth and man must be studied as coun-

terparts. The man cultivates the earth, and in turn the earth yields its nutrition to the man. The vast and complicated machinery by which the necessities of civilized life are distributed, constitute commerce, and for the protection of both commerce and the man there is the organization called government. The two poles of energy, however, are the man and the earth, and here is the first fundamental principle of political economy: the man is the consumer, the earth the producer.

The man is adapted to certain conditions of environment, and beyond these he cannot exist. Change the conditions within the limits, and he may adapt himself to them; change them so that the limits are exceeded by a hair's breadth, and sooner or later he disappears. So, when we consider the problem of the earth and life, we must look at the latter as a sort of contingent on the physical condition of the former. Let us for a moment look at the conditions by which life is environed.

So far as human knowledge can determine, the earth consists of a rock envelope or lithosphere surrounding a highly heated central mass. Without the rock envelope there is a water envelope which covers four-fifths of its surface and penetrates much of the uncovered part. Without the water envelope there is an aerial envelope, having a thickness estimated to be between fifty and one hundred and fifty miles,

which surrounds both the water and the rock envelope. These three envelopes, moreover, are constantly in movement and are always reacting upon one another. Under the influence of solar heat, the atmosphere is surging with tides and currents of its own, all its parts being thereby commingled. The water envelope, the sea, is also in constant motion, by means of which the warmer and the colder parts are mixed by the complex action of waves, tides, and currents. Under the action, too, of secular heat and other causes every part of the rock envelope is undergoing disturbance, rising here and sinking there.

In addition to the individual movements of each part of the earth, there is a very complex mutual reaction, the effects of which are far-reaching. Under the action of heat a part of the water envelope is vaporized, mingling with the air and, for the time being, forming a part of it. Sooner or later, however, chilled from one cause or another, the water vapor is condensed and falls in the form of rain or snow. That which falls on the land wears off and removes the more exposed surface, and as the water flows downward it degrades the uplifts and fills the sunken and hollowed places with the sediment, or material worn away, in time carrying the latter to sea level and distributing it along the margin of the land.

Of the physical condition of the central mass of the earth but little can be inferred, and practically

nothing is known. Notwithstanding its intense heat, one cannot safely assume that it is in a liquid form; indeed, whatever evidence exists, goes to show that such an assumption is out of the question. In the first place, the enormous pressure of the enclosing rock envelope is sufficient to prevent liquefaction; in the second place, in its relation to the sun and the other planets, it behaves like a fairly rigid body. The rock envelope itself appears to be about as elastic as glass, while the whole mass of the globe seems to be somewhat plastic, yielding about as freely as would a globe of mild steel having the same dimensions and shape.

Careful measurements have shown that the earth as a whole is about five or six times as heavy as an equal bulk of water. The rock envelope itself, however, has but little more than half as much density; it seems certain, therefore, that the central mass must be composed of material nearly if not quite as heavy as iron.

The various up-turnings, breaks, faults, and folds of the rock envelope have revealed much concerning its structure and composition. The outer part consists mainly of sediments which, previously worn from the surface rocks, have been transported and deposited by the action of water. In time the sediments so transported and distributed have again hardened into rock. As a rule, the under and lower layers have been so altered by the action of heat and

pressure in the presence of moisture that they seem to have been half fused in some instances, and are crystalline in others, thus constituting the "metamorphic" rocks. Below these deposits the sediments are absent, and all the material seems to have been subjected to intense heat: even among the sedimentary rock great masses of molten rock, much resembling furnace slags, have been intruded, and in many instances these have reached the surface as lava flows, or else have been exposed at the breaks and folds of the overlying sedimentary rocks.

The composition of the rock envelope is fairly well known. Some eighty or more chemical elements have been found, many of which are also known to exist in the sun. Of this number oxygen, calcium, iron, silicon, and aluminium form the chief part of it; carbon, sodium, potassium, sulphur, and hydrogen are probably next in abundance. So great is the proportion of these that it is hardly an exaggeration to say that were every other known element removed from the earth, the diminution in volume would be scarcely measurable. Gold, for instance, is one of the most widely diffused of elements, and it is used more or less by almost every people in the world; yet all the gold that has been mined would scarcely half fill a drawing-room of ordinary size.

The most casual inspection of the rock envelope, however, shows that the processes by which it has

reached its present form have been very complex; they likewise indicate that the resulting changes have required long periods of time. The various agents that have "weathered" or disintegrated the surface have been very active; and no part of the land seems to have escaped their work. The work, however, has generally been systematic in character. First, the exposed rock surface has been disintegrated; secondly, the substance worn off has been transported and deposited in layers; thirdly, the layers of sediment have been folded and crumpled by earth movements. All this is shown by the rock layers themselves. Their texture usually shows their origin at a glance. Originally deposited in horizontal sheets, they were subsequently warped, wrinkled, and cockled in about the same manner as though a thick envelope or cover were trying to fit itself about a body that had shrunken until it was several sizes too small. In some instances the irregularities have taken the form of long and fairly regular folds; in others the layers are much broken. In various places one may find great blocks of rock, more than one thousand miles long and a hundred miles across, displaced and tilted so that the upturned edge is perhaps a mile higher on the one side than on the other. In very many places the strata have been broken in such a way that one side of the break is several hundred feet higher than the surface of the other.

It is not many years since these movements of the rock envelope were thought to belong to a geological period that had closed, and that the rock envelope itself had become quite firm and rigid. The contrary, however, is true. Careful measurements show beyond doubt that movements in the rock envelope are going on even at the present time — slowly, very slowly, it is true, but at a rate that is approximately measurable.

That many of the relative changes in surface level result from earth shocks cannot be doubted; the vertical movement, sometimes aggregating many feet, is apparent to casual notice. Bradyseismic or slow movements have been noticed along various coasts for over a century also, but it is only within a few decades that they have been closely and critically observed. The rising coast of Norway and the sinking shore line of West Greenland have long been matters of comment and speculation among geographers.

More recent and critical examinations, however, have revealed something like a definite and systematic law — perhaps not universal and without exceptions, but still so general in its character that it has been commonly accepted. Briefly stated, it has been found that in regions in which sediment is being deposited a downward movement or sinking is going on, while in regions from which material is being removed a rising or upward movement is taking place. In time, doubtless, as investigation is more complete, the foregoing

statement of such a law may be somewhat modified, but at the present time it seems to be worthy of a place as a general truth. It is much the same as though a weight were placed on the surface of an inflated toy balloon. The added weight causes a sinking or depression of the surfaces of the balloon, and if the weight be carefully moved a little distance, there is an outward reaction at the point from which the weight is moved, and a consequent inward movement at the place to which the weight is moved. For many years these movements have been observed along the coasts of the continents, but it is only within recent years that they have been definitely investigated in regions far inland.

The old shore lines of Lake Bonneville, of which Great Salt Lake is the chief remnant, furnish an excellent illustration. The ancient shore lines along the escarpment of the Uinta Mountains are nearly one thousand feet above the present level of Great Salt Lake. The contemporary margins of the islands within the lake are about two hundred feet higher, a fact that is capable of only one explanation — there must have been an upward "crustal" movement at this locality.[1] The old shore line of Lake Ontario — now called the

[1] It is hardly safe to infer that the uplift resulted wholly from the desiccation of Lake Bonneville and the relief from the weight of its waters. On the contrary, Mr. Woodward has shown that the removal of the water is competent to account for only a small part of the uplift.

"terrace road"—has long been known, but only within recent years has the fact come to light that the terrace is warped, that it is no longer a true level. Certainly the terrace, having been a beach, was orginally level, and the disturbance can be explained only by the existence of an earth movement that has since occurred.

The result of recent investigations that have covered much of the two continents show that these slow movements are going on at nearly every part of the earth; they rarely exceed a few inches a century; they cover much larger areas than the sudden and catastrophic earthquake movements; and, moreover, no part of the earth seems to be free from them. Notwithstanding the slow rate of motion, the aggregate movement may reach several thousand feet, and the area involved may possibly equal the larger part of a continent. The cause or causes of these movements are unknown, but it seems probable that the transference of material from one part of the surface of the rock envelope to another may be one of them, or, at least, that a definite connection between the two facts may exist. Taking this view, it follows that the rock envelope or "crust" of the earth is in a condition of isostatic balance, and that any change or rearrangement of surface material is at once felt by the whole earth, and that the latter responds by changing its shape so as to keep the balance preserved.

This theory is by no means new, but in the past

few years it has acquired a new meaning, because it seems to underlie the fundamental laws of physiography, or earth-sculpture.[1]

Thus it is seen that the surface of the rock envelope is constantly undergoing a process of modification by two sets of forces: one wrinkling and folding the surface so as to form mountains, plateaus, and continents, and their corresponding depressions — all the topographic features, in fact; the other, equally constant in levelling them off and reducing them to a base level.

The recognition of this great principle has brought, not a new word, but the new use of an old word into geographic literature, the very appropriate term "physiography." It was employed by Professor Huxley some years ago to designate certain features of the river Thames and its basin, and as used it was expressive and admirably selected. Professor Huxley's employment of it was doubtless the forerunner of its more recent adoption as a permanent word in the

[1] Beyond the mere fact of changes in level, it seems a very debatable question among geographers whether the ordinary topographic forms are results of such earth movements or not. Formerly it was generally believed that the principal topographic features — the continents, plateaus, and mountain systems — resulted from the fitting of the rock envelope about a more rapidly shrinking interior, and it is probable that this belief is still held by most scholars, at least so far as the origin of plateaus and mountain systems is concerned. Either idea is capable of explaining most of the facts concerning their origin, but neither one alone nor both together will account for all of them.

nomenclature of modern geographic science. Indeed, so expressive is the meaning conveyed, the wonder is that it should so long have escaped geographers.

It is only a few years since that the underlying principle of geography was fixity — everything was viewed as unchangeable. Nowadays the idea that the modern teacher of geography emphasizes most strongly is that nothing in nature is unchangeable except eternal change. And so the term "physiography" has come to apply to earth-changes *viewed in the light of systematic processes*, the modifying clause being italicized because it is this afterthought that marks the distinction between Professor Huxley's use of the word and its renaissance. Perhaps it would be better to say that physiography is the evolution of the surface features.

Let us apply this thought concretely. Thus, according to former treatment, a river was a fixed and unchanging feature of the present rather than an ever changing panorama of action belonging to past, present, and future. As a feature of physical geography its torrential, transporting, and depositing parts were described, and the description closed with a consideration of some one or another of its unusual features. But from the standpoint of physiography, a more philosophical consideration is demanded than mere questions of morphology suggest. To the student of nature there is something about the regimen of a river that indicates intelligence; it certainly is not a

living thing, but it seems to be guided by positive intelligence; it behaves like something more than the mechanical agent it really is.

Let us imagine that in some place or other a plain has been recently formed—perhaps by the elevation of a shore deposit, perhaps by the drainage and death of a lake. In either case the drainage of the plain has many difficulties; and therefore a considerable time must elapse before the run-off develops anything like a channel that systematically collects the downpour of rain. One channel after another may be chosen and rejected. It may not be wisely chosen; or, if it be well selected, it may be so much obstructed by sediment that it is easier to make a new channel than to clear out the one self-clogged. This is the infant period of the stream's existence.

In time, however, the river reaches maturity, and thereafter it develops strength and vigor. It extends its infant tributaries until each has the character of a master stream. It pushes its headwater ravines backward to the limits of its basin, perhaps crossing a divide, and capturing and diverting a less vigorous stream. Farther down it spreads the sediment it cannot carry, building on both sides a flood plain; and if the mouth of the stream does not face too strong a tide, the flood plain may extend a considerable distance seaward, forming a delta and, possibly, a wide strip of made land along the coast.

When the headwater branches have reached backward toward the divide, and have carried away all the material they can reach, the old age of the river begins. At last it attacks the flood plain and carries that away too, and thenceforth it is in its senile stage. Very likely, however, there may be an elevation of its basin that rejuvenates it, for its actual history is usually much more complex than the theoretical case above given. Changes of climate, accident, the uncovering of a stratum of rock having a dip different from that to which the river has adjusted itself — all these may interfere with its normal development; but as a rule every river passes through the first two of these stages.

Or suppose that an additional factor, a progressive change of level, is introduced. Imagine that a coast region, fairly diversified with mountains and valleys, and generously supplied with rain, gradually sinks below sea level. Because of the general surface erosion, resulting from rain and from running water, the relief features have lost their boldness and have been worn down until their angular outlines have given place to rounded and graceful forms. The products of erosion, the rock waste, has not only filled the valleys, but a large amount of detritus has been deposited along the coast, in the meantime building a wide coast plain. But subsidence results in a more striking change. Little by little the coast plain is

submerged, and finally it disappears; then the foot-hills, or piedmont lands, gradually are buried; the valleys between the ranges are flooded; and finally the ranges themselves become peninsulas or, perhaps, are cut off from the mainland, each becoming a chain of islands. The rivers lose their character, and their watersheds are robbed of much of their area by the encroachment of the sea. The lower part or trunk of the master stream is drowned with the coast plain, and each headwater branch becomes a feeble trunk stream. Instead of a great river system of tributaries all gathering into a single trunk channel, there results a number of short mountain torrents; the whole river system seems to be, and practically is, completely dismembered.

But sinking and uplift usually alternate at irregular intervals, and sooner or later the latter movement begins to take place. The old coast plain, pretty well covered by marine and alluvial deposits, still preserves most of its surface character. So, as the uplift proceeds, little by little it emerges above sea level. As fast as the uplift takes place, the old, buried stream channels are recovered by their former occupants. Slight structural changes, such as the warping of the plain, may have occurred, and new stream channels are formed here and there. Perhaps the waters of some of them may be captured and absorbed by the older, revived stream; possibly

the young stream, having a steeper slope, itself may be the more vigorous, and therefore acquire the older river. In any case, however, the dissevered tributaries recover the old trunk channel and restore something like the former system of drainage.

In this way the process may be long continued; alternate subsidence and upheaval in turn bury and resurrect a stream, until the plain itself is dissected into isolated mesas or tablelands, and in time even these may be removed.

The classification of rivers as infant, mature, and senile may border on the theoretical, but nevertheless there is a very practical side. In the United States about the only infant stream of importance is the Red River of the North, which has just barely secured a fairly permanent channel in the level bed of the old glacial body of fresh water, Lake Agassiz. The mature streams are almost without number, but of typically senile rivers there is scarce an example. The lower St. Lawrence has disposed of the greater part of its flood plain, and some of the streams of New England are reaching the same condition; but they are comparatively, not absolutely, old in their stage of progress.

The physiographic history of a lake stands in contrast to that of a river. The latter illustrates the effects of water in motion; the former, of water at rest. Let us follow the history of one of the com-

mon marsh lakes. A stream in its downward course encounters a basin-shaped depression, and a lake is thereby formed. As the water accumulates in the depression, one or the other of two things in time will take place; either the basin fills until the inflow balances the amount lost by evaporation, or else the level of the water rises until there is a run-off at the lowest part of the basin rim.

From the moment the lake comes into existence, various factors at once set to work to destroy it. Vegetation is a very potent agent. Grasses and sedges border the shore; the moist ground favors their growth, and their dead stalks and leaves accumulate along the margin. Algæ, species of sphagnum, and other bog plants also get roothold along the shore, and spread inwardly toward the centre of the lake. Their dead remains likewise accumulate along the shore. Moreover, these same accumulations provide lodgement for the wind-blown rock waste — sand, dust, and every sort of fine earth matter that may be swept along by the wind. So there is not only an encroachment inward from the margin, but if the water be shallow, vegetation may get root almost anywhere at the bottom, and there carry on the process of filling. Time, therefore, is then the only factor required to obliterate the lake as it passes through the various stages of marsh, swamp, and meadow.

Rivers, as Gilbert puts it, are the mortal enemies of lakes. The stream that flows into a lake fills its head with sediments; the stream that flows out of it cuts the notch in the basin rim lower and lower until it is nearly or wholly drained.

In a like manner one might follow in detail the uplifts and foldings that make plateaus and mountain ranges, and also the weathering and degradation that sculpture the passes and fill the intermontane valleys with nutritious soil. All these processes, however complex they may be, are systematic and continuous; and, as will be seen in subsequent chapters, they are most intimately connected with mankind, his history and his activities.

There is another aspect of physiography, however, that is very far-reaching. Although organic life draws its nutrition from the earth, it obtains but very little directly from undisturbed rocks. The latter must be ground into fine particles and converted into soil. Now, by the operation of the various physiographic agents, not only is an abundance of rock waste formed, but it is transported to regions of much lower level and there converted into soil; and, in general, those regions having an abundance of soil are also the regions in which life is most abundant. So, in the end, the various physiographic processes are quite as necessary to human existence as are fortuitous conditions of climate. Indeed, as we shall learn,

were not all the conditions just what they are, life in its present forms could not exist. Communities therefore are most happily situated when they are in perfect harmony with their geographic environment; and they are wisest when they have learned to adjust themselves to it.

CHAPTER IV

The Distribution of Life

Of the fifty-three million square miles that compose the land surface of the earth, only a small area is capable of supporting the higher forms of life. If we take the United States as an example, the insular possessions excepted, nearly half the area is but very feebly productive, and therefore will be always sparsely peopled for that reason. Europe possesses a relatively larger, and Asia a relatively smaller, productive area. Africa and South America both have very large areas that practically support no life, while by far the greater part of Australia can support no population at all. Indeed, of the fourteen hundred million of human beings that people the earth, about one-half the number live in less than one-seventh of its area. Most living beings are compelled to live in the region that produces their food; man is practically the only species that can live beyond the boundaries of the region that produces his food; his is the only species that can provide for the transportation of food.

The reasons for this unequal distribution of life are partly topographic and partly climatic; sometimes they operate singly, and in other instances both are factors;

sometimes their effects are direct, and in other instances, indirect. In nearly every case the two factors go almost wholly to make up what is called *environment*.

The effects of topography are not difficult to understand. In the first place, a region of very steep slopes, however well adapted to be the home of animals with four legs, is not well suited to those of two. Man is the only animal capable of civilization, and the latter is very largely dependent upon intercommunication. The rugged topography of mountainous regions prevents intercommunication and makes isolation almost compulsory. One may see the effects of such isolation in instances widely remote. More than two thousand years ago the Basques, an Iberian people living in Spain, were driven into the fastnesses of the Pyrenees Mountains by the invaders of the peninsulas. Their geographic surroundings have been such that they have been out of touch with the rest of the world, and, as a result, they have remained practically unchanged in customs, social institutions, and language since that time. Even in the United States, where the facilities for intercommunication surpass those of the rest of the world, one can observe similar results. Thus the people in many parts of the southern Appalachians have been so isolated by the inaccessibility of the country in which they live that their social customs are in about as close harmony with the period of one hundred years ago as with that of the present decade. Similar

conditions are observable when one compares the Albanians with the Romans of the river plains and coast lowlands, or even the highland with the lowland Scotch. And in about every instance the explanation is the same: rugged topography, by making intercommunication difficult, practically isolates them, and they therefore preserve characteristics, manners, and social customs that have disappeared from more modern forms of civilization.

In general, Aryan civilization has pushed westward rather than eastward. This it did, not for reasons historical or political, but because the gentle and nearly level plains of the Atlantic slopes offered less resistance than the rugged fastnesses of the Asian highlands. Perhaps the most notable exception to this statement may be found in the case of movements of Sclavonic peoples noted in the following chapter.

In at least one other way, too, topography exerts a most important bearing on the distribution of life. Nutrition, the physical basis of life, requires soil, and soil is derived from rock waste. The higher forms of animal require, many of them, both flesh and vegetable matter for food; all of them in one way or another require the existence of plant life, and the latter draws its nutrition mainly from the soil. In other words, nearly all life is dependent on the near-by existence of the soil formed from rock waste, and life is most profuse in those places where there is an abundance of soil.

But soil is partly-decomposed rock waste plus certain

substances, such as water, the compounds of nitrogen, and other matter derived from the decay of organic substances. For the greater part the rock waste is formed by the erosion and weathering that goes on in the highlands. By means of water in its various forms, by winds, and because of the force of gravity, it is steadily moving toward sea level. On its way downward it is broken finer and finer, until at last much of it is an impalpable substance, mixed with coarser pieces. Some of it lodges in lake beds and similar depressions; some fills the river valleys, building deep and broad flood plains; some is scattered loosely over the surface rocks; and much of it is carried to the sea or to lakes, being finally deposited in the form of deltas and coast plains. It is in one or another of these physiographic forms that the rock waste, converted into soil, best meets the requirements of life.

It is for this reason, therefore, that most of the world's population is concentrated in the lowland plains. Indeed, not far from ninety per cent of it is thus distributed, and the reason, as has been noted, is twofold; the intercommunication of commerce is easier, and the regions themselves are food-producing. Moreover, in general, the civilization of the lowland population is of a distinctly higher type than that of mountains and plateaus.

On the other hand, the environment of highland regions is usually such as to produce strong characters. Through Khaibar Pass, from the highlands of

Asia, invaders and conquerors have followed one after another into the plains of the Ganges and the Yangtze almost without number. Indeed, in studying backward, we may follow invasion and conquest, one after another, until one is lost in the mists of antiquity. After two or three generations the invaders themselves, weakened by lives of ease and luxurious living, became the victims of conquest. In but few instances have highland people succumbed to invading hosts from the lowlands. The Basques, the Kelts, the Swiss, the Montenegrans, the Afghans, the Baluchs, and many other peoples may have been forced into mountain fastnesses, but they have never been driven from these strongholds.

The existence and distribution of life do not depend alone on the fortuitous arrangement of topographic forms. Other factors far more restrictive are involved, and of these the most important and far-reaching are the effects of heat and moisture. Granted that the difference in the average temperature of different parts of the earth is not extremely great, nevertheless the span of life exists between limits that are very close. Physical science is acquainted with a range of several thousand degrees in temperature — from the freezing-point of liquid hydrogen to the vaporizing temperature of the most refractory solids — yet the range at which life can endure for any great length of time is but little more than one hundred degrees. For instance, if the temperature of every

part of the earth were not higher than the melting-point of ice, life as we now know it could not exist, because water in its liquid form is the vehicle by which nutrition is conveyed from the earth to the organism, and water is also the substance by which it is distributed throughout the organism. So necessary is water as the vehicle of nutrition, that the organism deprived of it even for a few hours is apt to suffer fatally. It is obvious, therefore, that a temperature at which water cannot exist in its liquid form would be fatal to all forms of life as it is now constituted. It is equally obvious that life as it is now constituted depends upon both temperature and moisture, and it must adapt itself to the conditions surrounding, or it will disappear.

Thus, about thirty inches of rain, distributed in showers of not less than monthly intervals, are necessary to the existence of turf grass. If the total rainfall is decreased one-half, or if there are successive droughts of several months in duration, the turf grass will die. If there are cattle in the region, they must adapt themselves to other vegetation or else migrate; otherwise they, too, will die. And if there are people depending on the cattle herds, they also must change their employment or migrate.

The conditions of temperature and moisture of a region constitute its *climate*, and, on the whole, climate has far more to do with life and its activities than

topography; moreover, of these two fundamental principles of geography, climate exercises the greater control over mankind. Man can largely overcome the obstacles imposed by topography, but, excepting isolated cases, he can scarcely rise superior to the conditions of climate. Outside the torrid zone he cannot live without shelter and clothing; even in most habitable places he must depend to a considerable extent on artificial warmth. A casual thought, moreover, will show that a far greater area of the earth is made unhabitable by adverse conditions of climate than by unfortuitous conditions of topography.

Polar regions are too cold to support many forms of life. Grasses do not thrive, and the reindeer and musk ox, about the only grazing animals, live mainly on mosses and lichens. Except to a very limited extent, the grains cannot be cultivated there. The few native people, therefore, are almost wholly carnivorous, not only from choice, but from necessity. This fact alone prevents any high degree of civilization and enlightenment, even were all other conditions favorable. Moreover, from the nature of the case, no great concentration of population is possible in regions perpetually covered with snow and ice, or in localities where darkness is of six months' duration. The reasons, therefore, are climatic and not topographic.[1]

[1] The speculative profits of seal fur, whale products, and gold are almost wholly responsible for the presence of Aryan peoples in these regions.

Deserts are very sparsely peopled. Being near, or perhaps within tropical latitudes, they are apt to be too hot for habitation; in all localities they are too dry. A desert is a desert, not by reason of the sand, which, incidentally, is not there, nor yet for the intense heat; the essential feature is the absence of moisture. There is no dividing line between fertile regions and arid lands, nor between the latter and desert areas; in general, however, a region too dry to produce food-stuffs is a desert. About one-sixth each of Eurasia and North America, one-third of Africa, and two-thirds of Australia are either desert regions or else too dry to support more than a very sparse population. In the basins of the Mississippi, the Ganges, the Po, and the Yangtze one may find conditions of soil and climate that in the highest degree are adaptable to a dense population. In many instances these are agricultural areas that practically are self-supporting, in which the density of population exceeds three hundred to the square mile — not far from two persons to each acre. Certainly not all land is so highly productive, and the average noted is probably not very far from the limit. In general, however, the regions that are capable of producing the greatest abundance of food-stuffs are also the regions of densest population, and they are apt to be densely peopled because they are productive.[1]

[1] Large cities and regions in which manufacture is the chief enterprise, of course, are exceptions to this statement. The New England and

In the great upland regions, such as the western United States, Mexico, the western Chinese Empire, and the plateaus of Africa and South America, — in general, between the 2500 feet and 6000 feet contours of level, — the density of population is very low; only in a few small and highly favored localities does it exceed fifty to the square mile. A reason, therefore, is not hard to find: most of the great plateau regions are deficient in rainfall and in good soil as well.

There are also extensive regions that are unhabitable by man because of excessive moisture. For instance, the great rainfall in the basin of the Amazon renders more than one million square miles practically unproductive; the results of heat and moisture are forests instead of food-stuffs. A similar instance, though in a lesser degree, occurs in the basin of the Kongo. The tundras of the Arctic region and the various coast marshes are also unhabitable because of wetness, and their area aggregates between two and three millions of square miles. In still other instances vast areas are unproductive because the long-continued season of rains is followed by seven or eight months of drought. Of the entire land surface of the earth probably not far from one-third will always remain nearly destitute of population, and in by far the greater part the

Middle Atlantic states, because of the manufactures and commerce, are densely peopled; but the food for the greater part consumed there is brought from the prairie region.

sparseness or absence of population is due to climatic influences alone.

In such localities as the eastern part of the United States, eastern China, western Europe, their various prairies, coast plains, and flood plains, one finds the greatest possibilities of productivity. As a result, the greatest density of population exists in these regions. The rainfall is within the limits required by grass, grains, fruits, and other plant life upon which human beings depend; and in but few places is the temperature subject to great extremes. As a result, they are the home of the races that represent the activity of the world.

But sensitive as the distribution of human beings over the earth may seem, the dispersal of other species is a matter of even more delicate adjustment. It is hardly necessary to add that chance or accident plays but a very minor part in the matter: everywhere one is face to face with the fact that fixed laws are involved, and also that the laws are geographic in character. The question may be examined from two aspects; namely, the agents that aid and those that prevent dispersal.

Almost all forms of life are provided with means whereby they can extend their territory. Nearly all animals have the power of extended locomotion, and probably all have it to a limited degree at some time or other during their existence.[1] Most vertebrates

[1] Nearly all insects popularly known as wingless have at least one stage

walk, some fly, and some swim; a few species do all three. Even plants, which have not the power of voluntary locomotion, in many instances are able to extend their territory. The creeping roots of many species bear buds that develop into aerial growths; and the seeds dropped from almost any plant are distributed over an area considerably larger than that covered by the parent plant itself. Wind and water are highly important factors in the distribution of all sorts of life, even including mankind. It requires no great feat of the intellect to understand that the wind may carry seeds, like those of the dandelion or thistle, into foreign territory, and even across high mountain ranges. The wind may accomplish still more; it may blow from place to place seeds that have no furze until they finally tumble into a river or other body of water. Moreover, it may blow the seeds or even floating animals a long distance from the shore. It is quite certain that many of the Polynesian Islands have been peopled in part by the aid of the winds, which have blown the canoes from inhabited shores to new and unpeopled atolls.

In conjunction with the wind, marine currents have aided largely in the distribution of life. The waters of the Gulf Stream have strewn much of its course

in which they have well-developed wings, and are capable of flight. Some of the aphides cast both their wings and their legs, but not till after they have become fixed to the plant on which they are parasites.

with minute organisms that were brought from the Caribbean Sea, and seeds, plants, and floating animals also have been carried from tropical American to European shores. The great Equatorial Current has been a potent factor in the distribution of life among the islands along its route, operating largely in conjunction with the winds. Roughly, the flora of these islands consists of two general classes —the plants whose seeds were carried by winds and currents, on the one hand, and those brought in the crops of migratory birds, on the other.

In general, when we consider the unrestricted dispersal of species we find an interesting aspect. In the temperate zones, as a rule, the extension of territory has been from west to east; in the torrid zone, from east to west. And the explanation is not hard to find; the winds and the ocean currents have borne them.

Local and accidental factors that cause the dispersal of life are not rare. Rivers, especially during flood seasons, carry many sorts of seeds which are self-sown along the lower flood plains. But few species of forestry have a wider territory than the willows, and their distribution is almost wholly the work of stream waters. The water hyacinth is another example, and its accidental introduction into two or three rivers of Florida and the adjacent watersheds has nearly destroyed navigation in some

of the streams, and has almost ruined their dependent industries.

Commerce, accident, and design have resulted in the extension of the territory of many species. The domestic fruits and food-stuffs have accompanied Aryan migrations, being found almost everywhere that man lives. The cinchona tree, once confined to the Peruvian Andes, by the intervention of man has been carried to the East Indies and the islands of the Antilles. The cultivated species of cotton brought from India found a new territory in the United States, and the latter now produces nearly four-fifths of the world's supply. Tea, so long a monopoly of China, now thrives in Ceylon, Japan, and the United States. The ostrich is at home in California, and the camel still survives in the desert region of the lower Colorado. The gypsy moth in Massachusetts and the codling moth in California are adopted charges that each locality would gladly surrender. The Colorado beetle in the United States and the rabbit in Australia are accidents in the great laws of dispersal that have compelled the readjustment of several industries. And so, with the many means of dispersal, one might wonder why the distribution of life does not approach a condition that is almost homogeneous.

But there are regions penetrated by ocean currents in which the life forms carried there will not survive. There are quite as many swept by the winds which

the winds never sow; and there are also areas sown with seed that the soil never fertilizes. There are flights which birds do not make; and there are boundaries that all the powers of locomotion will not surmount. Such extraordinary conditions cannot, of course, exist without causes, and the latter constitute the natural barriers to dispersal. The barriers to dispersal, moreover, may be far more potent preventives than the agents that effect it.

The barriers to dispersal may be of various kinds, but, in general, they are of two classes; namely, physiographic features and environment. High mountains are a barrier to such species as are not provided with organs of locomotion; for if the individuals of a species are not provided with means of locomotion, they certainly cannot cross the ranges. Moreover, though the hardier individuals of a species may surmount a lofty range, though they may survive the low temperature of its summit, the conditions of climate on the opposite may be so different that the species would not survive even if the range were crossed.

The ocean and its arms have been more or less effective as barriers to plants and most species of animals. A few birds endowed with extraordinary powers of flight have crossed the narrower arms and even the broader stretches of the sea. To the few species of aquatic birds that speed with a velocity of more than sixty miles an hour, the crossing of the Atlantic, therefore,

would involve a matter of not more than forty or fifty hours. Such instances, however, are rare and unusual, and the ocean is a barrier to about every species except man. To mankind it is less effective than either a great highland or a desert. The Greek peoples could much more readily scatter along the shores of the Mediterranean than they could surmount the Balkan Mountains, and until the advent of the railway, the sixteen thousand miles around Cape Horn was both shorter in time and more economical than the passage of the Rocky Mountains.

Deserts are very decided barriers, for not only may the surface be extremely rugged, but the absence of moisture is even a greater obstacle. Except in the seed stage, few species of plant life can retain their vitality for any length of time in a region of such extremes. From San Bernardino to Yuma the Colorado Desert is less than two hundred miles across, yet the cattleman who attempts to drive a herd from one place to the other must break his herd into small bands and select the time for crossing with the greatest care. Old settlers of Southern California still relate the story of a cattleman who attempted to drive a herd of eight thousand head across this desert. Had he broken his herd into small bands of three or four hundred, most likely there would have been no very serious loss. Instead of this plan he made the attempt to take the whole herd across.

When they had reached the first watering-place, there was water for only a small fraction of the number; by morning the herd was crazed with thirst; to add to the difficulty a mirage, the illusion of a lake, appeared at a short distance; the herd stampeded, and as a result their bones are about the only relief in the landscape of the adjoining desert waste. Instances of similar kind might easily be multiplied; the grewsome story of the emigrants who perished in Death Valley only goes still further to emphasize the effectiveness of the desert as a barrier to the spreading of species.

Environment, generally considered as a cause of variation in species, is even more effective as a barrier. Every species exists between certain limits — limits of temperature, of rainfall, of conditions of soil, and of nutrition. If, for instance, the lower limit of temperature for a species is 35° F., it will be exterminated by freezing weather; if it requires a monthly rainfall, it will not survive long-continued droughts; if certain conditions of soil are essential, it will perish without them; if certain definite food-stuffs are necessary, it will starve unless they are provided. If all the conditions of environment have a wide range, the realm of the species will be wide; moreover, it may be extended by transference to similar areas far removed. It will most likely thrive there, but still it may not. It may find enemies that are ready to

exterminate it, or it may find the region already pre-'empted by others that resist encroachment. So one may readily find species capable of a wide dispersal occupying each a very limited territory, while others that are sensitive to very slight changes have each a remarkably wide range.

The distribution of life over the earth is a magnificent exhibition of nature's balance. Disturb the latter ever so little, and there follows a general and compulsory readjustment all along the line. In a traditional story Professor Huxley has jocularly illustrated a great truth. As the tradition goes: "When all the old maids of Bromwicham in a unison of rage drowned their cats, there came a plague of field-mice that before had been slain by the cats. But when the field-mice came, they began to destroy the humble-bees; and as the latter fertilized the clover flowers, when they were no more, the clover died; and when the clover was no more, the farmers gathered their herds and marched out of Bromwicham. And the five and twenty hundred maiden ladies died of vexation."

The story has so many exact parallels that it is quite as near to *the* truth as to *a* truth. Thus, years ago, the cane rat infested the island of Jamaica to the extent that the sugar industry was in great peril. In other localities it had been learned that the mongoose had proved a deadly enemy to the rat, and so

the mongoose was brought to Jamaica with the expectation that it would make short work of the cane rat. Contrary to expectations, however, the mongoose found the ground birds much more to its liking, and little by little as these disappeared, there came such a plague of cattle "ticks" that the herds were threatened with destruction. The ground birds had prevented any great increase of the parasitic insects, but when they had disappeared, the latter quickly became an intolerable pest. A still more singular result is related by Dr. Eugene Aaron, who investigated the subject closely. The cane rats in many instances were driven from the fields to the houses and the orchards, developing a climbing instinct that undoubtedly they possessed, but had not practised. In fact, the readjustment resulting from the introduction of the mongoose involved not only domestic affairs, but legislative measures of international character as well.

The foregoing pages illustrate in a rather elementary aspect the general laws concerning the distribution of man and the inferior forms of life. There is much evidence, however, to show that changes in the height of the various continents with relation to sea level have had more or less to do with the migration of species. An elevation of five hundred feet would connect North America and Asia — probably in several places, certainly in one. With an elevation of two

thousand feet there would be only a narrow strait or two between the northeastern shores of America and Europe. Now changes of level much greater than these have occurred in the past, and the Northern Realm of America is so much like that of Eurasia that one may be led to suspect a community of origin. At the same time, each region has specific differences that are most easily explained by a subsequent separation of the two areas.

That Asian species have reached the American continent by way of the peninsulas now separated by Bering Sea is certain. The species are in evidence, and there can be no doubt about their Asian origin. In both instances the evidence is strongly in favor of a dry-land migration, but still it must be regarded as circumstantial and hypothetical rather than positive.

In studying the distribution of life from the geographic standpoint one fact stands out in bold relief; namely, that the underlying law is the law of merciless strife. It is a never ending struggle in which not necessarily the strongest, but the fittest, survive — that is, survival belongs to those that are the most perfectly in harmony with their environment.

CHAPTER V

Effects of Topography on Commercial Development

It has already been noted that the great period of discovery which followed the blocking of the trade routes by the Turks was the result of commercial enterprise, and incidentally of a quickening intellectual development. But the question occurs: Why should the blocking of these routes create a disturbance that revolutionized the whole world? If the former routes of trade were obstructed, why not go to the one side or the other and open new ones? Let us put a parallel question: Suppose one were to block the cañon of the Colorado River, why should not the water remove the obstruction? The answer is easy: It couldn't. And the same answer applies in both cases; there were no other routes to take. Conditions of topography and climate had made all others well-nigh impossible. These routes had been travelled highways for more than three thousand years, and there were no others that under prevailing conditions were feasible. The conditions that made them were geographic, and the conditions that made other routes impossible were likewise geographic. Man

may ordinarily overcome and rise superior to his environment, but he cannot annihilate it; and among the things he cannot do is to make possible trade routes in impossible places. When we come to look at the matter squarely, one conclusion becomes irresistible; namely, that in general about all the economies and activities of mankind are governed by conditions of topography and climate.

In the preceding chapter it was shown that the rock envelope is undergoing constant movements, that elevation and subsidence — imperceptible except after long intervals — are going on in pretty nearly every part of the earth, the most noticeable results being in the vicinity of coasts. Let us now study the effect of some of these movements on human activities.

All along the coast of the New England Plateau, from Maine to Chesapeake Bay, a subsidence has taken place. Most of this coast region has a rugged surface, and as the latter sank below sea level, the valleys became bays and inlets, while the ridges formed the peninsulas and headlands that enclosed them. In other words, the lowering of the coast and the consequent intrusion of the sea made a great number of natural harbors. Now harbors are essential for marine traffic. Vessels cannot well lie out in the open, waiting days and weeks, perhaps, to discharge and receive their cargoes. Not only is it unsafe, but it is expensive; and of two ports, one of which has a safe, protected anchorage and the other

none, it is hardly necessary to designate which of the two will get the carrying trade. If there were no good harbors, if all vessels were compelled to lighter their cargoes on a lee shore, then one part of the coast would have no advantage over another, and there would be little choice in the matter. But where the geographic conditions make safe, commodious harbors in one place, and the reverse conditions in another, the question is different — the commerce of the sea will go to the coast having the good harbors.

The result of good harbors is emphasized most clearly in the case already noted. The stretch of coast from Portland to Baltimore includes very nearly all the good harbors suitable for vessels of deep draught on the Atlantic coast of the United States, and practically all the marine commerce of the country goes in and out of these ports.

The gentle slope of the coast plain south of Cape Henlopen, and the spits and barrier beaches that hem the coast, so completely obstruct navigation that only where some drowned river channel furnishes a natural approach for vessels does commerce have a fair chance, and these conditions, it is well to observe, are wholly geographic in character.

For want of good harbors — and there is scarcely a score of them along the whole extent of its coast — Africa is characterized by a low grade of civilization and a very backward state as to the progress of its native peoples. In the past century, about all the progress has

resulted from external and not internal factors. In strong contrast to Africa is Western Europe; and the difference is due, in no slight degree, to the existence of its harbors. They have invited and encouraged a close touch with the outside world; while in Africa, the absence of them has repressed intercommunication.

One must also bear in mind that human agency is no insignificant factor in the matter of harbors. If the harbor does not offer the full measure of protection required, the man builds sea walls to make it a safe anchorage, and dredges or deepens channels to make it accessible. The basins of Liverpool, the ship channel of New York harbor with its buoys and range lights, and the sea walls that protect the entrances of so many harbors in Europe and America witness the indomitable pluck of man in overcoming difficulties that seem almost unsurmountable. Along the shores of Lake Michigan there were better facilities for commerce than at Chicago, but the pluck and perseverance of man won; and it was largely the enterprise of man that took the commercial supremacy away from Philadelphia and landed it for all time at New York.

One must also bear in mind that the mere existence of harbors in themselves does not insure commercial greatness; there must be habitable, productive land back of them. Commerce implies the existence of a more or less intelligent and civilized people. Unless a region is productive of food-stuffs of some kind or

other, it will not long be habitable; and if not habitable, the harbors of the region could hardly be considered as harbors at all. In other words, the latter are supposed to be something more than mere indentations of a coast; they imply commerce; and commerce, because it brings about intercommunication of peoples, also implies the diffusion of civilization and a higher plane of intelligence.

There is another coast form that has a definite place in the literature of geography — the cape. Ordinarily we are apt to toss off the consideration of this feature with the statement that it is "a point of land extending into the sea," and let it go with this disposition of it. As a matter of fact, the physiographic aspect of the cape is its least important part. Furthermore, the definition will hardly bear close criticism, because the term is applied indiscriminately to spits and hooks, to almost inconspicuous bends in a coast, and to rocky islets.

The essential feature about a cape is its bearing upon navigation, and therefore upon commerce. Cape Clear, a rocky island off the Irish coast, does not interest any one as a "point of land," etc., but as a fine place for a wreck it is of the deepest interest to every navigator who enters the Channel. Cape Hatteras, the angle of a barrier beach off the Sounds, is a similar case. Other capes, like Good Hope, have a very definite place in history. At first it was dubbed

the "cape of the furies," because of the terrific storms that beset it; but when King John of Portugal learned that its discovery had made an open door to India, he generously rechristened it with its present name.

Now the casual inspection of almost any map will demonstrate the fact that there are capes that are not "points of land," etc., and also that not every point of land extending into the sea is called a cape. The essential feature about the cape is the fact that it is an exposed point of coast that affects commerce and navigation. St. Roque can hardly be called a typical cape from a physiographic standpoint, but it is very much a cape from the view of the master mariner who sails along the South American coast. It is most emphatically a cape to the shipper and the underwriter; for, take away the warnings of its presence, and up go the rates of insurance, and up go also the prices of commodities that must round it in getting to market. Coffee and capes, therefore, may have something in common about them, and thereby the cape touches the most vulnerable part of the man — his pocket-book.

The effect of the cape as an obstacle to commerce is very clearly emphasized in the case of Sandy Hook, a spit at the entrance to New York Bay. Because of its unfortuitous position, it compels all vessels of heavy draught to take a roundabout and a very difficult route from the lightship to the docks.

In order to make the navigation of this channel clear and safe, there must be lightships, beacons, and range lights, a multitude of buoys, and all sorts of warning signals, the expense aggregating probably more than a million dollars a year — and almost all of this because Sandy Hook interferes with the open navigation of the lower bay.

But topographic forms, as well as coast outlines, play a very important part in the activities of life; and even distance above sea level is an important factor, though perhaps indirectly. Thus, a comparatively small fraction of the world's population lives at an altitude greater than seven or eight hundred feet above mean tide. Now the difference between the climatic conditions of the five hundred and the two thousand foot contour is so slight that it cuts practically no figure at all. The difference in the conditions of soil, however, is very great.

A thick layer of level soil, it is apparent, is the most favorable condition for the support of life; and inasmuch as physical life gets its nutrition mainly from the soil, life can be nourished best where, along with proper conditions of climate, there is the best soil.

The relative value of highlands and lowlands is well illustrated in the case of the New England Plateau. During the past fifty years there has been but little gain in the population of the uplands; in many places the population has decreased, and the productivity has

retrograded. In the lowlands, on the contrary, there has been a steady increase in the number of people. The value of farming lands in the upland region has gone steadily downward, while in the valley lands it has materially increased.

Aside from the question of fertility, the rugged surface of most highland regions is unfavorable to the activities of life. Free commercial intercourse is one of the essentials of modern civilization; the high ranges and deep cañons are, therefore, great barriers to commerce. The steep escarpments of the Rocky Mountains and the ravines that have dissected the plateaus are so formidable to commerce that freight can be shipped around Cape Horn, a distance of sixteen thousand miles, for a much lower rate than that across the one thousand miles of western highland.

The Balkan ranges were so rugged that the Greek peoples found it easier to scatter along the Mediterranean coast and to cross the Ægean Sea. Either way was a line of less resistance than that imposed by the inhospitable ranges. The arid plateau of Iran and the lofty knot of the Hindu Kush have been an almost insurmountable barrier between Occidental and Oriental civilization; and it is likely to exist until the railway shall thread its passes—just as it has broken down the barrier of the Alps or of the Andes.

But the high range is sometimes more than a barrier to be surmounted by physical force; it may be a

climatic barrier. The range that faces an ocean wind chills its moisture, and a deluge of rain falls on the seaward side, while the opposite slopes are of necessity arid. So the life forms that require a great deal of moisture cannot survive, even if they are carried beyond the summit; while the species that thrive on the arid side find the conditions equally fatal to their existence on the opposite slope. The flora of the western slopes of the Sierra Nevada is so different from that of the eastern side that at first sight the two seem to have nothing in common. Even the landscape forms are so unlike that they seem to belong to regions very remote, one from the other. The difference is even more noticeable in the Peruvian Andes, where the summit separates a region of the most profuse tropical growths from hopeless desert waste.

Notwithstanding the fact that rugged mountain regions are unfavorable to a concentration of population in most respects, they are essential to civilization in certain ways. The breaking and upturning of the rock folds have made accessible many of the minerals and metals of use in the arts and the industries of mankind. Gold and silver are essential to commerce, and for more than three thousand years they have been recognized by civilized man as the chief media of circulation. Indeed, until the bank and the clearing-house came to the front, they were the chief mechanism of exchange. But gold and silver almost always are

products of mountain regions, and their deposition in veins is one result of the processes by which mountains were formed. Copper is mainly a product of mountain folds, and perhaps no other metal, save iron, holds so important a place. Because of its low resistance to the passage of electricity — silver alone surpassing it — copper is the one metal practically fit for the transmission of electric power. Indeed, the extension of the uses to which electric power may be applied is pretty closely governed by the price of copper.

In most mountain regions, too, there are considerable areas that, although too rugged for cultivation, produce enough grass to feed large herds of cattle and sheep. The dairy products of Switzerland, the beef product of the "Plains," the clips of llama wool from the Andes, and of "camel's hair" from the Asian plateaus, are results of the grazing industry in mountain slopes that otherwise would be unproductive. The rug-making industry that has made the plateaus of Armenia and Iran famous for more than three thousand years had its origin and development in just such conditions. Had the soil been highly cultivable and productive of great crops of food-stuffs, the rug-making industry would never have survived, even had it obtained a place. It is practically fixed there because of conditions of topography and climate.

It is evident, therefore, that geographic conditions localize certain industries in mountainous regions that,

from the very nature of the case, could not exist elsewhere. The population of these regions is sparse, partly because of the rugged character of the surface, but mainly from their low power in the production of the food-stuffs ; and in the main the products of these regions cannot be obtained elsewhere. Gold, silver, and copper, llama wool and rug stock, are found only where they are found, and the loci of production cannot be moved unless they are moved to regions having the same conditions of environment.

Montane valleys, on the other hand, are apt to be important centres of population. The surface of the valley, usually a flood plain, is nearly always level, and the soil is deep. In fact, the level surface and deep soil are natural results of the movement of rock waste, no matter whether the filling material of the valley is an alluvial or a marine plain. The essential feature of nutrition is present, and for that reason there are the possibilities of a more or less dense population. The Sound, Willamette, and Sacramento-San Joaquin valleys are illustrations in point ; they represent the greater part of the natural wealth of the Pacific coast region of the United States. In the Appalachian and New England regions nearly all the cities of importance, the ports excepted, are situated in the montane valleys, and the same idea is borne out in the various Alpine valleys : in them is concentrated most of the wealth and the activities of the surrounding country. It is

apparent in the great highland regions of Asia, where the vale of Kashmir has added its literature and history to the world; indeed, the application of this principle of economy is so well-nigh universal that it scarcely needs more than a mere allusion.

But if the valley has a high degree of importance, the pass, or transverse notch, across the range has a rank that is relatively higher in the scale. From the very fact that the mountain range is a barrier to intercommunication, it follows that almost all the intercourse of peoples on the opposite sides must be concentrated at the passes. Railway lines must of necessity seek the mountain passes. We see this in the traffic that finds its lines of least resistance over Mont Cenis, St. Gotthard, Brenner, Marshall, Fremont, Great South, Mohawk, and a great number of other passes and gaps.

As an instance of the economic value of the pass, let us consider Mohawk Gap across the range that forms a part of the Appalachian folds. Up to the present time no topographic feature within the United States has had more to do with the development of the great industry of transportation than this. It has made New York the Empire State; it took the commercial supremacy from Philadelphia and made New York harbor the centre of commerce of the New World; and it is to-day the chief factor in regulating traffic rates between the East and the food-stuff markets of the Mississippi Basin.

Within a very few years after our national history had begun it was discovered that the newly acquired territory of the Northwest was shut off from communication with the Atlantic ports because of the Appalachian Mountains. But two gateways at that time seemed available — one by way of Cumberland Gap to Pittsburg, the other by way of the Hudson River and Mohawk Valley. The falls and rapids between Lake Erie and Lake Ontario intercepted navigation to the eastward, and so the site of Buffalo became a natural focus of trade in just the same manner that Pittsburg, at the head of navigation of the Ohio, had also become a great market.

At that time the railway was scarcely more than a visionary dream, and a canal seemed the only way of opening traffic communication between the two parts of the country. Work on the Cumberland and Ohio Canal was begun, but the canal was never completed. The Erie Canal quickly materialized and became a great highway of commerce. With the opening of the canal two things were accomplished. First, the produce of the western part of the state found a ready market; second, the vessels from foreign ports, which previously had been compelled to wait a long time for return cargoes — in many cases going back in ballast—found little or no difficulty in getting them without delay. As a result, little by little shipping began to leave Philadelphia, and only

a few years elapsed until New York City became the metropolis of the continent. In this, as in other cases, man was a potent factor, but in this instance his chief work was in taking advantage of geographic conditions.

In recent years, the six railway tracks that follow this natural route have absorbed most of the traffic between Chicago and New York, yet the canal itself is still a route of traffic. Freight going from Chicago to New York along the shores of Lake Erie and the Hudson is lifted less than one thousand feet. Over other competing lines the lift aggregates not far from four thousand feet. Over this line a locomotive of the type now in use will easily haul a train of ninety cars, each loaded with sixty thousand pounds of freight, or one of one hundred and twenty-five empty cars. Over most of the other roads the grades are so steep that freight trains must be broken into two, three, and even four sections, each requiring two locomotives for the steeper grades. Under the circumstances, then, it is hardly a matter of surprise that the route of the Erie Canal practically fixes the rates of freight traffic between New York and a very large part of the West.

Instances similar in character could be added almost without number. Khaibar Pass, one of the few narrow defiles through the rugged, desert highland that separates the Europe of history from the

Asia of history, is an example. The British government has long recognized it as the key of the gateway to India; and should it ever pass into the hands of the Russians, Great Britain's grip on her Asiatic possessions will become very uncertain. In the South African war that so thoroughly shook the British Empire to its foundation stones, the chief struggle centred about the pass that was a doorway between Natal and the Boer republic. In the various colonial wars in America almost always there was fierce fighting about Fort Ticonderoga and Crown Point, from the fact that these were strategic points guarding the easy passage between Canada and the Hudson River Valley; and, indeed, this entire thalweg is nothing more nor less than a pass between the St. Lawrence and New York Bay.

The river and the physiographic features connected with it are potent factors in the concentration and distribution of life and its activities. The navigable river is an open highway free to all, and when we consider a stream like the Mississippi and its tributaries, with about fifteen thousand miles of navigable waters, we may well ponder on its inestimable value to the nation. Pittsburg and Fort Benton are nearly two thousand miles apart, as the crow flies, but both may be reached from New Orleans. Fort Benton is only three hundred miles from Lewiston, a river port on a tributary of the Columbia. When the people of

the United States are ready to put one-tenth of the energy into the building of canals and the improvement of waterways that has been devoted to the railway, there will be an evolution of internal navigation the like of which does not exist anywhere else on the face of the earth.

In the settlement and development of new nations the rivers have usually been the pioneer routes of transportation. A good steamboat may be built for less than thirty thousand dollars, and this sum is about half the cost of an ordinary train of cars. The river costs nothing; the railway, with its equipment, at the minimum of cost, represents an expenditure of forty thousand dollars per mile.

The river valley may be regarded as a type of pass, inasmuch as it is a line of least resistance to commercial intercourse. In rugged countries almost all the railway lines are built along river valleys. The flood plain of the river is a natural railway bed, and there is not a line reaching New York City from the west that does not utilize stream valleys for the greater part of its extent. The same is true of the railways of the western highlands.

The river valleys of Siberia have been important factors in the spreading of Sclavonic civilization. The master streams of Siberia flowing mainly into the Arctic Ocean have but little importance as traffic highways. The lateral tributaries, however, are very fortunately

situated. The passage down a tributary to the master stream and up the tributary on the opposite side is an easy one. The portage across the divide to a tributary of the next master stream does not present great difficulties; and so from basin to basin across the great plain from east to west, from Moscow to the head of the Amur, the several river valleys constitute lines of least resistance. The place of these in Russian history becomes evident when one studies a map showing the distribution of Sclavonic peoples. Such a map shows narrow belts of settlement in parallel lines, the one Sclavonic, the other Turanic; the former along the valleys of the tributaries, the latter occupying the more inaccessible lands between them.

The bottom lands, or flood plains of rivers, hold also a most important place in the economic history of a country. To the very highest degree the energies of nature have sorted, distributed, and arranged the ever moving rock waste so that it presents the maximum of adaptability to the requirements of life. Except in rare instances, the flood plain possesses the greatest fertility and the least resistance to the activities of life. Therefore they are almost always densely peopled. The flood plain of the Nile sums up about all there is to the Egypt of history. It probably gave to Aryan peoples the alphabet now used by most of the civilized nations of the world, and certainly it has shaped the destinies of at least one great Semitic family. The Egypt of geog-

raphy is a very broad and a somewhat vaguely bounded area; the Egypt of history is the narrow strip made by the overflowing waters of the Nile.

The growth and development of Chile is another illustration of the value of flood plains. Most of the northern part of this state is a hopeless desert. There are fine grazing lands in the mountains, it is true, but the lower lands are habitable only in the irrigated flood plains of the short Andine streams. Each one of these is densely peopled and the centre of great activities; the mesa lands between are incapable of supporting anything more than the lower forms of life, and but very few of these.

Even in places where the flood plain may be flanked by level and fertile lands, the greater productivity of the flood plain is nearly always emphasized. Thus, in the northern part of the Great Central Plain, the prairie lands yield not far from twenty bushels of wheat to the acre; the bottom lands yield about thirty. Farther south, an acre of bluff land produces scarcely more than one bale of cotton; an acre of bottom lands will produce nearly twice as much.

As a résumé of the foregoing paragraphs, it may be said that topographic forms, both horizontal and vertical, very largely govern the various activities of life, and that in very many ways national history has been shaped by them. In an essay remarkable for the clearness and force of its arguments, Professor Rossiter

Johnson has shown that the partition and absorption of Poland was a foregone conclusion, and that from a geographic standpoint there was scarcely an excuse for the existence of Poland as a nation. That this view is a correct one cannot be doubted, for neither to the north, the south, the east, nor the west was there a topographic barrier between that separated it from the surrounding nations. In the partition of the country, therefore, each part went to the country to which it geographically belonged.

CHAPTER VI

The Effects of Topography and Climate on the Economic History of the United States

In the development of the affairs of a nation two processes are usually going on; namely, the acquisition of territory, and the subsequent adjustment of the people to their local surroundings — that is, to their geographic environment. In most instances the process of adjustment is slow, and nearly always it is accompanied with more or less friction. Now this aspect of national development is an exceedingly important one, for the friction and difficulties that attend the adaptation of a people to their surroundings go a long way in making their history. Moreover, the sooner a people realize the fact that their economies and activities are largely controlled by geographic environment, that is, by conditions of topography and climate, the more quickly will discord and adversity give way to harmony and prosperity.

In various ways one may note the operation of these processes in our own country from the very earliest colonial periods. The Virginians, for instance, adapted their employments to the conditions they

found. Soil, climate, and topography were all splendidly adapted to the prosecution of a new industry, tobacco growing, and as a result there was but little friction until the greed of the English merchants practically destroyed the industry and drove the Virginians into the revolutionary party that was growing and taking shape in the Northern colonies. So far as Virginia was concerned, therefore, the war of the Revolution had as much the character of an industrial as a political revolution.

In the case of the New England colonies, however, one may readily find an abundant evidence of the friction that entered into its history. For nearly one hundred years the people struggled along, seemingly unable to discover that the greater part of the land was thoroughly unfit for agriculture and, during all this time, crops of glacial boulders alternated with crops of trouble.

The first material readjustment of this condition of affairs was an industrial revolution, and its exciting cause was a matter of topographic detail — a question of geography, pure and simple. The rugged surface of that region, dipping abruptly below the line of sea level, gives the coast that indented and fjorded line that makes the best of natural harbors. Farther south, from Chesapeake Bay to the Gulf of Mexico, a level coast plain dips so gently below sea level that a vessel cannot approach the shore unless some buried

river channel of former geological times affords a navigable way; even then a long line of spits, hooks, and barrier beaches may block the few navigable estuaries. As a result of these topographic conditions, the great industry of sea commerce was concentrated at the natural harbors of the New England shores.

And when the New Englanders began to recognize these conditions, poverty and adversity began to give way to prosperity. Even the wretched and disgusting theological bickerings began to be dropped; for a people who are thrifty and prosperous have but little time for quarrels. Because of the geographic conditions noted, commercial interests began to dominate, and these were materially aided by another geographic factor — namely, the great belt of white pine just back of the coast. Pines thrive best in a coarse, gravelly soil where there are extremes of climate. And, in the case in question, the glacial drift furnished the rocky soil, while a moderately high latitude afforded the conditions of climate. Now, as a matter of fact, no other timber that grows surpasses white pine for the construction of vessels; and so the New Englanders began to make the ships that sailed out of their harbors. The close of the war of the Revolution marked the beginning of a new industrial epoch founded upon the wisest of principles because in harmony with geographic environment; and the

commerce of the sea grew by rapid strides until the canvas of the new merchant marine whitened every sea under the sun.

The traditional cow that kicks over her bucket of milk is not only ubiquitous, but she exists in about every department of life. She was very much in evidence in the political issues that led to the War of 1812, and never was the bucket more effectively overturned than at this time. With a single stroke of the pen the magnificent fleet of merchant marine was swept off the sea and practically disappeared from view. So far as the New England states were concerned, it was not to revive; for when those ports were again open to foreign trade, only a few years were to elapse until hulls of steel propelled by steam should take the place of sailing vessels. Even at the end of the nineteenth century, ninety per cent of our foreign traffic was carried by foreign vessels.

The embargo of 1807, together with the non-intercourse and non-importation acts, no matter how wise the effect intended, proved a clear case of biting off our national nose to spite the national face. The industrial chaos resulting scarcely can be imagined. The millions of dollars that had been actively employed in foreign trade were thrown into idleness, and a stagnation of business followed. There was one hopeful feature, and one feature of momentous importance resulting, however. Up to the time of

the various enactments leading to non-intercourse, pretty nearly all the manufactured articles used in this country were imported; indeed, under colonial rule, the manufacture of certain goods in the colonies, or even the importation of the machinery for making them, was an offence punishable by imprisonment. But when the effects of the embargo began to settle upon the country, the necessity of home manufacture forced itself in no gentle manner on about every community. And here a geographic factor began to obtrude itself. In spite of its now illogical name, manufacture required something more than the energy of hand and brain, and that something was *power*. At this time steam had scarcely become a factor in the economic development of the nation; about all the power utilized came from falling water. But water power depends on an abrupt slope, and the New England Plateau possesses this feature in a remarkable degree. As a result, the capital that had been forced out of its former employment was reinvested in mills and factories. It is characteristic of the streams of this region that nearly level reaches of water alternate with abrupt slopes, and so comparatively long stretches of almost slack water are relieved by rapids and cascades. In other words, the utilization of water power for manufacture depends upon certain topographic conditions, and these were available to the highest degree in the New Eng-

land Plateau. They existed elsewhere, — in the southern Appalachians as well, — but in the New England states there was the stimulus of idle capital. Still, not a little enterprise developed in the Southern states. In general, a wave of manufacturing impulse swept over the country, and companies for the production of textiles were organized, not only in the New England states, but in Charleston, Richmond, Baltimore, and Philadelphia. The fad for homespun and home-made textiles grew to be a craze. All sorts of clubs and associations were formed for the purpose of fostering the new industry, and the question became a burning issue in politics. In North Carolina, Vermont, Maryland, Ohio, Kentucky, Connecticut, Virginia, and Pennsylvania, the members of the various legislative bodies were urged either by enactment or by public opinion to appear in garments of home-made material. Industrial parades and expositions were held, and the newspapers were plethoric with leaders that boomed the superiority of American products, or, perhaps, with dire threats levelled at the American woman who should refuse to discard the tawdry trappings of European manufacture for the home-made products.

The importation of merino sheep was the beginning of an important era in the manufacture of textiles. Napoleon's invasion of Spain was followed by the confiscation of many estates, and the famous flocks

of merinos, in many instances, were transferred to American soil. For a time our consuls employed themselves with little else than buying fine sheep, and very soon the sheep ranges extended from the White Mountains to Pamlico Sound, and the water power of Massachusetts, Connecticut, and Rhode Island became the centre of a great woollen textile industry. But the manufacturing enterprises were not confined to textiles alone, they grew to include about everything the people needed. There was but a single important exception to the new era of prosperity — namely, the cordwainers and rope-makers; their trade was gone forever, for there were no vessels to be supplied with rigging in the future.

But the great change in the industries of a people was made; the idle capital was again employed, and the prosecution of the new industry was in harmony with the conditions imposed by geographic environment. The change of employment brought new and different social conditions. The complications preceding the War of 1812, therefore, resulted in an industrial revolution, and, in general, it placed a large population on a plane of civilization that was distinctively higher. Granted that the destruction of commerce was wrought in a manner at once bungling, unstatesmanlike, and cruel; admitting that greed, avarice, and lust were underlying factors — the general results were beneficial. One can get a grain of com-

fort, however, in the fact that most revolutions have gone that same way.

By turning back the pages of the economic history of our country, we cannot escape the fact that each of our forward leaps has resulted from an industrial revolution, and that not until our industries were founded and built up so as to be in harmony with the conditions of their environment, could any great amount of prosperity ensue. The state groups that so long have held their places on the map of the United States are founded on something more than convenience and political gerrymandering; their basis is an economic one, and is founded on geographic laws. If, for instance, we take the New England Plateau, we find there a centre of light manufactures of a character that requires the highest degree of intellectual and mechanical skill. Doubtless some of these might thrive elsewhere; certainly the manufacture of cotton textiles could be more economically carried on in the South, for in no other way can the cost of transporting the cotton from the fields to the far-distant mills be eliminated. Originally located in this region because of the water power, the manufacturers have remained there because a highly educated people is able to take advantage of public demands and to seize the opportunities presented.

In the middle and southern Appalachian region we find still another sort of manufacturing enterprise;

namely, the making of structural steel, and this industry has also a geographic basis. Before the pig iron can be converted into steel, and the latter rolled out into rails, girders, plates, and billets, several tons of coal must be used for every ton of metal produced. It is cheaper, therefore, to ship the iron ore to the coal than *vice versa*, and for this reason the great centre of manufacture of structural iron and steel must be either in or near the coal mines. Granted that other manufacturing enterprises exist in the vicinity of the coal measures, and that certain agricultural products are grown, it becomes apparent with a moment's thought that the manufacture of iron and steel will always be the fundamental industry of this region. Even taking into consideration the high wages paid for labor as compared with those paid in Europe, the price of steel billets and rails at times is materially lower here than abroad.

In the localization of the iron and steel industry, geographic environment, it has been shown, has been the dominant factor, and this is strongly illustrated in the establishment of the steel-making centre along the shores of the Great Lakes. Among the chief expenses in the manufacture of pig iron are the quarrying of the ore and the transportation of the product. If, in one locality, a given amount of labor will quarry a ton of ore while in another it will produce six or eight tons, there is no question about

which miner can afford to sell his product at the lower price. And if one operator can load his ore on barges, while another must haul by rail the same distance, there is also no doubt about which can sell the ore for the lower price; for the cost of getting the ore to the smelteries is practically the cost of labor and transportation.

Now among the older rocks that border Lake Superior are vast deposits of good iron ore so near the lake shore that the ore can be quarried and transferred to the hold of the vessel for a very small sum per ton; indeed, in places it may almost be blasted from the quarry into the barge. Transportation by water to the shore of Lake Michigan or that of Lake Erie is a small item compared with the cost of railroading the ore, and so the latter is conveyed to its destination by freight steamships and barges. At the lower lake shore it meets the coal brought by canal barges from the interior, and, as a result, enormous steel-making plants have grown up where the "lines of least resistance" meet,—Chicago, Toledo, Cleveland, Lorain, and Buffalo. Because of the development of a new line of industries, a new social economy has resulted, and this, as one cannot help seeing, is an echo of geographic conditions. In other words, the man is adapting himself to his environment.

The adjustment of the industries of the Great Central Plain affords another striking example of indus-

trial development as governed by environment. From a topographic aspect this plain from the Great Lakes to the Gulf is marked by monotony of detail—open prairies alternating with occasional timbered areas. From an industrial and social standpoint, however, the northern and southern sections could not have been more unlike had the barrier between them consisted of a thousand miles of rugged mountains. At first the barrier was an imaginary line that extended along the thalweg of the Potomac and Ohio rivers; afterward it became a very ugly fiat line that was fixed at the parallel of 36° 30′; in time it became an embattlement that separated two hostile camps.

And yet it was merely a climatic boundary after all—a line north of which cotton would not grow, and south of which wheat would not pay. In other words, there were two industrial regions with a geographic barrier between them; and for a long time the people were unable to adjust themselves to their environment and at the same time rise superior to it.

The southern part of the Great Central Plain was the first to be developed. Its period began just after the war of the Revolution, and the stimulating cause, strangely, was the invention of the steam engine in England. When the application of steam as a motive power had passed the experimental stage, the English textile manufacturers found themselves with a new power of unlimited extent, and practically with no work

for it. But John Bull is very long-headed and very practical: he simply transferred the cotton industry from Hindustan to England, putting the mills in Manchester and the cotton fields in the Southern states.

For a while the cotton grower was hampered by the fact that the Hindu coolie was paid a daily wages varying from two to five cents a day — the latter sum for the skilled weavers and spinners, the former for the field hands. In order to obviate this difficulty brain had to be pitted against brawn, and Eli Whitney invented the cotton engine or gin, which, in separating the furze, or fibre, from the seeds, did the work several hundred times as rapidly as it can be done by hand.

The cotton grower was handicapped also by the question of labor. Not only were the social conditions in the South unsuited to the white laborer, but the latter was physically unequal to the work demanded in the cotton fields. As a result, the African slaves that had been employed impartially throughout the country, both North and South, were gradually drawn to the South; they could stand the hot and moist climate, and they were adapted to the labor. The question of the relative cost of slave and free labor was one that the cotton grower settled to his own satisfaction, and in less than thirty-five years the Southern states produced more than two-thirds of the world's cotton crop; at present it produces nearly

four-fifths. The chief mistake that the cotton grower made was the adoption of a policy which permitted the manufacture of his product to go elsewhere. It was practically the planter and not the manufacturer who paid freight on the raw product from the fields to the factory. It was the planter, too, who failed to get the profits that would have accrued had the manufacturing establishments been placed in the vicinity of the cotton fields. The planter, therefore, was at the mercy of the outside man, and the latter was not always altruistic enough to consult the interests of the former. So it turned out that the English manufacturer helped himself to the first profits, while the New England cotton factor got most of the remainder. The Civil War, one of the results of which was the establishment of cotton manufacturing plants all along the Fall Line and in the vicinity of the cotton fields, worked an industrial revolution in the South, and the iron and steel making which grew with rapid strides in the southern Appalachians finally put this whole region on an industrial basis that was more closely in harmony with its geographic environment than ever before.

In the North Central states agriculture has always been the dominant industry, and whatever manufactures may have developed, they have been usually correlated to the handling and the harvesting of the crop of food-stuffs. The completion of the Erie

Canal opened communication between the West and the East, giving these states an outlet to tide water — an outlet subsequently enlarged by the various trunk lines of railway. With a commercial outlet assured there was a marvellous growth of population, and at the close of the present century this region has become probably the greatest centre for the production of food-stuffs in the world. Nearly one-fourth of the wheat and meat, and about three-fourths of the Indian corn consumed in the world, are produced there.

The movement of the wheat-growing and flour-making industry to the Northern states of the Great Central Plain has been followed by very far-reaching changes. So long as the wheat was grown in the hilly farms of New England, the old-fashioned cradle and the hand flail were about all that were required to harvest and prepare the crop for market; indeed, the rugged surface practically forbade the use of such machinery as is now employed.

When, however, the wheat crop was garnered on the fertile prairies of the West, the cradle gave way to the reaper, the reaper to the self-binder, and the latter to the header, or to the mammoth harvester that cuts a swath fifty feet in width, at the same time threshing and sacking the grain. The hand flail dropped out of sight, and the steam thresher, that separates and cleanses twenty-five hundred sacks a day, took its place. In the flour mills the old chan-

nelled millstones were too slow, and the roller process of making flour took its place. In order to get the farm products to the densely peopled manufacturing and commercial centres of the East, trunk lines of railway were organized from the short end-to-end roads; iron rails gave place to steel rails, weighing three or four times as much; and the automatic brake, that puts the train under perfect control at the touch of a valve, took the place of the cumbersome and uncertain hand brake. The locomotive formerly employed weighed from twenty to thirty tons, and carried steam at a pressure of sixty pounds; it could haul not more than forty or fifty loaded cars on a level. The modern freight locomotive weighs from sixty to one hundred tons, and with its steel boiler that carries steam at one hundred and sixty pounds, hauls ninety freight cars, each loaded with sixty thousand pounds of freight.

The result of this enormous development and localization of the growing of food-stuffs has been not only a commercial but a social revolution as well. The establishment of the cotton fields and of various textile factories in the United States reduced the price of prints and domestics from about thirty cents a yard to less than five; the concentration of wheat-growing in the prairie states brought the price of flour from about twelve dollars a barrel to less than five. Perhaps the living expenses of a family might not have

been materially less, but under the changed conditions they lived much better on the same amount of money;[1] in other words, the plane of civilization was higher than before. And the conditions were wholly geographic in character.

The region at the eastern base of the Rocky Mountains, commonly known as the "Plains," is another example of the effects of environment on industrial development. So far as topography is concerned, the region in question, which extends westerly from the twenty-five hundred foot contour above sea level, belongs to the Great Central Plain. The barrier that separates it from the more fertile prairie lands is one strictly of climate. West of the twenty-five hundred foot contour the rainfall, both in quantity and period of distribution, is insufficient to produce more than two or three crops of grain in every five. Only along the narrow flood plains of the rivers are crops certain, and these, at times, must depend on irrigation.

The close of the Civil War gave an impetus to the settlement of this section, and for nearly a generation the people struggled against a fate which was inevitable. Blindly ignorant of what ought to be apparent, they dragged out an existence or starved.

[1] According to the statistics gathered by Mr. Edward Atkinson, the purchasing power of the wages of the day laborer has been increased more than eighty-five per cent. The cost of transporting a bushel of wheat from Chicago to New York, in 1868, was 42.6 cents; in 1900 it is less than fourteen cents by rail, and about six cents by water.

Finally there came a time when the grain farms were abandoned for stock-growing, and then adversity disappeared and prosperity came.

The reason why stock-growing succeeded seems paradoxical when one studies the details. It is a fortunate thing that turf grass will not grow to any extent in this region, while the coarse, wiry, and less nutritious bunch grass thrives; and here is the paradox. By the middle of June practically all the grass on the ranges turns brown, the aerial growth perishing for want of moisture. Now the mere change of color does not materially affect the nutrient qualities of the grass; but while a single shower will leach all the nutrition from turf grass, the dry bunch grass will stand a considerable wetting; and even after the snows of winter have fallen, it is still good fodder. And so, because the bunch grass retains its nutrition throughout the fall and winter in lands that are too arid to produce grain or turf grass, the region in question has become an area adapted to grazing — in other words, an industrial enterprise, founded upon conditions of geographic environment, has developed and prospered.

The western highland constitutes a region *per se*. For the greater part there is not sufficient moisture for the growth of food-stuffs; only along the occasional flood plains of the mountain streams is there an attempt at farming. In the northern part there

are a few cattle ranges; in the southern part much of the country is an absolute desert. Yet, as a whole, the region is an indispensable part of the nation. It produces gold and silver, the medium of circulation required in commerce, and copper, the one thing essential for the transmission of electric power. The rugged, broken folds and tilted blocks of strata, seamed everywhere by deep cañons, are a great detriment to transportation, and therefore to commerce; but those same denuded rock folds have laid bare the veins in which the precious metals were deposited. Mining is, therefore, the dominant industry of the region, and, as is evident, the reason is geographic.

The Pacific states also constitute an industrial region that is peculiar to itself. All that part of the United States west of the crest of the Cascade and Sierra Nevada mountains is popularly, but not quite accurately, known as the "Pacific Slope," and the barrier that separates it from the region to the eastward is one of climate. The rains are seasonal, little or no moisture falling from May to November.[1]

The temperature of winter, moreover, is not very much lower than that of summer: in the southern part freezing weather is almost unknown; in the

[1] The amount and the time of distribution depend on the latitude. In Sitka, Alaska, rains may be expected during ten months of the year, July and August being the exceptions. In San Diego the occasional showers between November and April rarely aggregate more than eleven inches of rain; to the southward it is still less.

northern valleys it is not very common. Because of these climatic features, semi-tropical products give a peculiar importance to the region, and although wheat is by far the most valuable crop, the wine, citrus fruit, and merino wool make it an industrial region unlike any other in the country. At one time the Pacific Slope was the great centre of placer gold-mining, but it required only a brief time to demonstrate that the cultivation of wheat, wool, and semi-tropical products could be made far more remunerative; and so the people quickly adapted themselves to the better conditions imposed by geographic environment. From this time there began the period of prosperity that has few equals.

CHAPTER VII

THE EMPHASIS OF ESSENTIALS

PROBABLY most of the difficulties that beset the teacher of geography culminate at the recitation. Not only are there perplexities concerning the treatment of the subject-matter, but one cannot always decide upon the proper application of the material used. No one would endeavor to place equal stress upon all the topics and illustrations of the text-book; so it falls to the teacher not only to select the topics and arrange their sequence, but also to give them their proper emphasis.

The best-balanced courses of study used in American schools cover seven or eight years, of which all but the first three include the use of text-books — some courses with and others without supplementary reading. But no matter what the course may be, the recitation is always the focal point, and almost always the teacher's capability is judged by the results of the recitation period. Perhaps there is no other part of the work that requires greater skill and judgment than that displayed in the logical treatment of the course of study.

There is no course of study so good that the class

teacher could not better it, so far as individual use is concerned. The first thing, therefore, is to organize within the prescribed course an individual course that will cover all its requirements. To do this requires experience and judgment, both of which the teacher is expected to possess. The individual course must have unity; it must be so designed that the pupils will discern the logical connection and relation of the topics of each subject; it must likewise have a definite end in view, so that the daily work may not be aimless. It is not necessary, nor is it usually advisable, to follow slavishly the sequence of lessons as they are arranged in the text-book.

About the first thing a pupil, for the first time using a text-book, must learn is the art of studying from a book. This may seem easy, but it is not. At first nearly all the energy is spent in spelling and pronouncing words; and until this is done unconsciously the thought contained in the text does not appear. In the experience of nearly every teacher pupils ten and twelve years of age will listen with attention and delight to such literature as "Hiawatha," or Irving's tales, or even to heavier reading such as McMaster's larger "History of the United States"; yet when the children themselves attempt to read these works, the result is apt to be failure. Of course, in such cases, there is but one thing to do; namely, to teach the pupils how to get the thought from the text. In other

words, the training must be such that the mechanical part of reading is done unconsciously. In order to accomplish this the recitation at first must be made a study exercise, in which the pupils must be taught how to get intelligent thought from the printed page.

There is still another important point that makes the work of the intermediate grades in geography difficult and trying to the teacher. The mere acquisition of a fact by the pupil scarcely can be called knowledge; at the best, it is a very empiric stage of knowledge. The more important step is to so work upon this fact that by experience and association it develops into actual knowledge. This also requires skill and judgment on the part of the teacher — and, incidentally, these attributes ought to be expected of every instructor.

Perhaps most of the memory tasks that form a part of the school work in geography are accomplished in the intermediate years of the course, as a rule, while the pupil is studying the elementary text-book. A few well-meaning but misguided writers on educational topics pronounce such a proceeding atrocious and cruel, but a moment's thought will suffice to show that memory tasks can be more easily accomplished between the ages of five and fourteen years than at any other time of life — far more easily than during the adult period. A certain amount of memory work in geography is absolutely necessary — quite

as essential, in fact, as the learning of the various number combinations in arithmetic or the paradigmatic work in Latin. Geography deals with places, nations, terrestrial features, and processes; and their names and character must be learned before one can well discuss their mutual relations.

But judgment is certainly required in this matter; for instance, the text of the ordinary advanced geography contains about fifteen hundred geographic names, and the maps about five times as many in addition. As a matter of fact, the average man or woman of intelligence is rarely familiar with more than three or four hundred geographic names, even in a very general way. The average pupil on leaving the grammar school undoubtedly possesses a considerably larger stock—and promptly proceeds to forget all but about one hundred, or, possibly, half as many more. He then adds to his stock the names that may be called the "unexpected," that is, the names that come into use through discovery, political change, industrial movement, or change of environment.

Now the selection of the places and geographic features to be remembered requires not a little discretion on the part of the teacher. There are many names, with which the California pupil must be familiar, that deserve no place in the vocabulary of the New York pupil; there are, moreover, names and localities necessary to the Philadelphia boy that

have no place in the geography with which the pupils of Boston must be familiar. The teacher who possesses the sort of knowledge that comes with experience will be apt to exercise a great deal of care in this respect. Every teacher must learn by experience that well-assimilated, actual knowledge about a few peoples or places is worth many times as much as a smattering of empiric knowledge about a great many — and it is all a matter of judgment.

But the training which the pupil receives in the memory work, although it cannot anticipate the unexpected, nevertheless can provide for it in a way; that is, the teacher of ten years ago could not anticipate what now is expected to be known about Klondike or Johannesburg or Manila or Puerto Rico. Moreover, it would have been very foolish to add several thousand names to the pupil's geographic vocabulary in anticipation that some two or three of them might possibly grow into sudden importance. A wise teacher, however, will provide for just such possibilities by training the pupils into the cultivation of a proper and necessary habit. The geography of actual life is learned, not so much from text-books and cyclopædias, as from current literature; and this knowledge will become useful and valuable accordingly as it is made over from the empiric to the actual stage or not. That is, when a geographic name comes into prominence, if one immediately

refers first to the map to learn its position and general relations, and then to the cyclopædia or gazetteer for special facts, there will result more or less actual and practical knowledge. Evidently the chief task of the teacher is to train the pupil into this way of doing until it becomes a *habit;* and it is well to bear in mind that for every time reason controls an action, habit controls it ten times. To train the pupil into the acquisition of such a habit should be, therefore, an explicit aim of the geography teacher. Next to the actual accomplishment of a given result the acquisition of the habits that will bring it about is the best legacy that the teacher can bequeath to a pupil.

One of the most difficult matters upon which the teacher is called to exercise judgment is to determine whether or not a given concept is within the mental grasp of the pupil. If the pupil does not understand a given matter, there are the possibilities of explanation. Explanation may or may not bridge the difficulty; it all depends on the teacher's skill. But if the pupil cannot understand the concept, why, he simply cannot; specious illustrations done up in words of one syllable, or glossed over in short sentences, will not help the matter. Judgment suggests that the matter should be dropped until the pupil has reached the stage at which it can be understood. Perhaps a skilful disciplinarian may compel the memorization of

words and phrases, but the most capable teacher that ever lived cannot force a pupil to understand what he cannot understand. It does not follow, however, that the fact itself should not be presented; the latter may not only be simple, but it may be very essential. Thus the fact that when water vapor is sufficiently chilled it is condensed, is a very essential thing to know. It is a very simple fact, and one with which all pupils should be familiar. The explanation, however, is a very difficult matter even for an adult mind to apprehend much less comprehend.

And so with hundreds of other facts that come into the experience of one's life. It would be folly to attempt the explanation until the latter can be understood; it would be manifestly unjust to withhold it after the pupil has become capable of grasping it. This, it may be claimed, is a matter of judgment on the teacher's part; quite true, but judgment is supposed to be an equipment of the teacher.

Another matter closely connected with the conduct of the recitation is the treatment of the definition. Almost always the consideration and discussion of a topic begins with the formal definition; occasionally, too, it ends there. That the definition has an important place in the study of geography cannot be gainsaid; still, in a way, the formal definition is not an essential. The perfect definition, like the geometric point or line or surface, or like the theoretical pendulum, exists more

in imagination than in fact. To cover every conceivable case the definition must be stated in the abstract, and in this care its meaning is not apt to be apparent. Thus, the legal definition of *wound*, as "solution of continuity," would not appeal to any one who had not been trained in the law. The definition of *network* in Johnson's Dictionary — "that which is reticulated and decussated with interstitial vacuities" — is equally valueless to one who is not an expert lexicographer. To be of value to an immature mind, the definition must possess something of the concrete; and if it possesses concrete attributes, it ceases to be perfect, though undoubtedly more useful. The idea of a *hill* as "a big heap of dirt" carries far more of meaning than when defined as "an accidental accumulation of detritus." As a condensed summary of information upon a given subject the definition may be a fairly good illustration of concise and exact expression, but as a vehicle to convey meaning to the pupil it has but little value. Moreover, there are many words whose meanings are apparent, and yet not the most expert lexicographer can define them clearly and concisely. Nor yet does the ability to repeat the words of the definition necessarily imply an understanding of the thing. Sissy Jupe could not inform Messrs. Gradgrind and M'Choakumchild that a *horse* was "a-quadruped-gramnivorous-forty-teeth-namely-twenty-four-grinders-four-eye-teeth-and-twelve-incisive-sheds-coat-in-the-spring-in-marshy-countries-sheds-hoofs-

too-hoofs-hard-but-requiring-to-be-shod-with-iron-age-known-by-marks-in-the-mouth," but she probably knew the thing itself quite as well as the saleratus-faced Bitzer. And, on the other hand, the teacher must bear in mind the fact that geography and definitions need have but very little to do with each other. The pupil may know all about a thalweg, and not be able to define it; or he may be able to reproduce a most critical definition, and be totally devoid of any real knowledge of the term.

With all due regard to the wisdom of our forefathers, whose legacy most geographic definitions are, it is not preposterous to claim that the latter are hardly suited to modern ideas of geography. A river, for instance, may be a stream of water flowing through the land, but this notion is its most superficial aspect. From the economic standpoint the river does something more than merely to flow: it carves and carries away its basin, building fertile, food-producing plains of the material transported. Perhaps the teacher may still prefer the former idea, but the latter is the one that connects the river with the activities of life.

The cape may be conventionally a point of land extending into the sea, but in its broader aspect it is an exposed point of the coast that affects commerce and navigation. Cape St. Roque, for instance, is not a "point of land extending into the sea" any more

than is the whole Iberian Peninsula, but it has a very definite place in the commerce of South America. The extreme northern point of North America, however, answers to the definition of a cape, but for more than fourscore years since the time of its discovery it has had no name; indeed, it has practically no place in the world's economies. From the physiographic aspect, the cape has but very little importance; it may or may not possess economic importance, but if it does, the latter deserves the emphasis.

A desert is not necessarily "a vast, level plain of sand," nor, as one dictionary gives it, "a deserted or forsaken place." From a physiographic standpoint it is a region unproductive for want of moisture; from an economic aspect it is a barrier to the distribution of life—valueless because it will not support life. The desert may have any character of surface, and the alleged "sand" may be any kind of rock waste. Unproductivity and aridity are therefore the features to be emphasized, rather than levelness and sand.

Ocean currents, especially such as the Gulf Stream and the Kuroshiwo, have no great modifying influence on climate except in a very remote way. In this respect their effects are inconsiderable, and Western Europe could worry along very well without the Gulf Stream, so far as temperature is concerned. The drift from the Gulf Stream has a most important mission, however: it keeps the harbors of Western

Europe free from ice all the winter, and, therefore, permits unchecked commercial intercourse. The shores of Western Europe form one of the great centres of the world's commerce; the Labrador coast, with harbors naturally quite as good, have no part in human activities. The former are always free from ice; the latter are frozen half the year. And evidently the stress of emphasis is not the warming effect of the stream water, but the keeping of the shores free from ice. The great indentations of the coast certainly have a modifying effect on the general climate of the coast, preventing both the intense cold of winter and the fierce heat of summer, as compared with regions more remote from the sea.

In the discussion of mountains, the range and not the peak should be the theme. Physiographically, the range is a much broken and worn fold of the rocks. From the economic aspect the emphasis may be placed upon the contents of the range — the minerals and metals valuable in the arts and sciences, if there be any — or else the effect of the range as a barrier to commerce and intercommunication. In the discussion of mountains two other features are intimately related — the valley and the pass. The former is almost always densely peopled; the latter an important route of traffic; and on these features the emphasis belongs.

And so one might go through the entire list of geo-

graphic definitions, finding fault with each in an empiric way. As a matter of fact, however, the geographic definition may have two aspects, one of which is abstract and technical, while the other expresses a relation to life and its activities. The former carries but little meaning to the child; the latter, though imperfect, has a very definite educational value. One must bear in mind that the definition is not a part of the science of geography, but of language. It is the art of expression, and an art, moreover, that demands the highest degree of skill. In a way, the best definition is the one which the pupil himself constructs. Its value lies in the fact that the teacher may read between the lines to discover whether or not the pupil has the right idea — very crudely and bunglingly expressed, most likely, but fairly correct as to meaning. Nothing but experience and practice will bring accurate and concise expression, and one can scarcely expect either accuracy or conciseness in immature minds.

In dealing with the question of mathematical geography, it is a very easy matter to commit grievous errors of judgment. One may not always properly discriminate between topics that are purely astronomical and those that have a very direct bearing on geography. For instance, such a problem as the calculation of the longest and the shortest days, that is, the periods of sunlight for the different latitudes, is both interesting and instructive in its proper place; but it belongs to

the study of astronomy, and but remotely to that of geography. Just when and where it should be discussed, depends on the judgment of the teacher. So, also, with such topics as the precession of the equinoxes; the daily motion of heavenly bodies as seen at the poles, on the equator, and at mid-latitudes; the approximate calculation of latitude, and similar questions: they have a definite place in the school curriculum, but they do not belong in the geography course of the grammar school.

Nevertheless, there are certain facts in astronomy that the teacher should bring out, and they should be learned by observation. The pupil should be required to observe the position of the sun on the horizon, say, in June, December, and during one or two intermediate months; he may also measure the noon shadow of some fixed object or other on the same dates. By means of these observations he learns the fact that the sun apparently swings north and south, making a complete oscillation once each year. Now it is necessary that the pupil should be in possession of this fact early in the study of geography, but it would be unwise to attempt an explanation of it until the teacher is satisfied that it can be understood. The fact itself is needed; the explanation is not required until the pupil engages the study of astronomical geography.

The same idea comes up in a more practical way in the study of the light zones. The latter belong to

astronomical geography and should be studied in that connection, as resulting from the inclination of the axis together with its constant parallelism. At this period the explanation is necessary and proper; before that time it is not. The fact itself is required in the study of the zones of climate, that is, the isothermal zones; but in the study of the latter the wise teacher will omit all reference to inclination of the axis, tropical circles, or polar circles. The fact that the heat belt oscillates north and south, thereby being a means for the distribution of heat, is the essential feature to make plain, and this part of the subject pertains to geography. The cause of the oscillation belongs to the science of astronomy, and its explanation is neither essential nor proper in the geography class.

A more difficult matter is the selection of the material for the various grades—that is, what to take and what to omit. It goes without saying that no concept should be presented that the pupil cannot grasp. This, of course, would preclude any systematic study of mathematical or astronomical geography in the primary and intermediate grades; and it is certain that no systematic study of the subject should be attempted before the pupil reaches the high school. But it is equally certain that many principles of mathematical geography are required to be understood during the course of the intermediate and grammar grades. Thus, the succession of day and night has come into the

experience of every mortal being; and so far as the fact is concerned, it is learned long before the pupil begins his school course. By the time he is able to undertake the systematic work in the course, anyway not later than the fourth year, the explanation should be undertaken. All the principles involved may be learned by holding a small terrestrial globe *in the proper position*, so that the sunlight shall fall upon it. The words in italics are not for emphasis, but to indicate that the teacher has something to do, and that the success of the pupil's observational work depends largely on the teacher's skill in this particular.

In the performance of this exercise several principles in astronomical and mathematical geography are involved; the succession of day and night are the result of *rotation*. Now rotation involves a knowledge of *axis*, and the last-named term of necessity carries with it probably the only new idea and new term; namely, "pole": all the other principles, most likely, have come into the experience of the pupil. It would not be out of place or in bad form if another fact be taught at this time, and the term "equator" be added to the pupil's vocabulary.

The construction of maps on scale has already been discussed, and with this branch of the laboratory work the elements of latitude and longitude may be learned. The first lessons most certainly should be studied from the globe; from the latter the subject may be then

transferred to the map. From what has already been learned, there will be but little difficulty in understanding the general principles of latitude; longitude will be rather more perplexing, because younger pupils cannot readily appreciate the importance of the prime meridian, much less understand the reason for its being where it is.

The work in intermediate grades, therefore, would better be confined mainly to exercises in comparative latitudes. For instance, most of the great centres of activity in the world are situated very near to the forty-fifth parallel; in the United States and Asia they are chiefly south, in Europe mainly north of it. This parallel being practically midway between the equator and the north pole, its number and position are easy to remember. The eighteenth parallel is also important, inasmuch as it touches or closely approaches all our recently acquired possessions. It is even worth while to know the important places crossed by the equator, but it is doubtful if many students have possessed themselves of this information.

A few comparative longitudes are worth memorizing; thus, Toronto, Pittsburg, Charleston, S.C., the east coast of Florida, Panama, and the western point of South America, are all very near the eightieth meridian. The eastern point of Maine (near Eastport), San Juan, Puerto Rico, and Cape Horn have about the same longitude. A great many exercises of this kind

may be devised, but those are best from which the teacher can get the best results. The idea is not to memorize figures, but to get a good mental picture of the globe with a number of important localities in their relative position. For instance, if one has a mental picture of the American continent with South America due south from North America, the picture is incorrect. And so with various other relative positions: the teaching which fails to bring out the general facts of relation and direction is faulty teaching.

The mathematical treatment and study of latitude and longitude, the varying length of the degree, the relations of longitude and time, are best deferred until the pupil reaches the subject of circular and angular measure in the arithmetic. Then it should be taken in detail to the maximum of the pupil's ability, and the course of instruction should include both the study of standard time and the calculation of local time. The estimation of the latitude and longitude of various places in the county usually can be made to within a minute of arc from a good county map, and a few reckonings of this character will be instructive, not for the memorization of figures, but for the value of the training.

There are occasional problems in land measurement and description that require demonstration or explanation. The laying-off of land into sections and townships that nominally are square is much like fitting

a square peg to a round hole. If the instruction in latitude and longitude has been well done, it will not be difficult for the pupil to understand that the east and west boundaries of sections and townships cannot be meridians and at the same time enclose square areas, hence the necessity of corrective parallels. Now all this pertains both to square and to angular measure, and it should be studied in detail with the work in arithmetic.

Pupils are required to be familiar with the zones that have such an important place in school geography, and in mathematical geography a certain amount of emphasis is always placed upon the position of the tropical and polar circles as zone boundaries. This is certainly proper, provided that the emphasis is placed upon these circles as the boundaries of *light zones.* As a matter of fact, however, the teacher is very apt to make them the boundaries of *heat zones*, and to this there are very positive objections. Heat zones and light zones are roughly coincident, it is true; but while the latter are bounded by the tropical and polar circles, the former are limited by isothermal lines that are exceedingly irregular. The light zones belong more especially to astronomy; the heat zones, on the contrary, are zones of climate, and should be emphasized in the study of geography. The essential feature, moreover, is the irregularity of the boundaries. Thus the Labrador coast and the

British Isles are in the same light zone; but while the latter is one of the world's great centres of activity, the former is practically unhabitable, the former being in the frigid and the latter in the climatic temperate zone. Labrador and central Greenland are in different light zones, but they are practically in the same zone of climate. It is not necessary that the teacher should omit the discussion of the one for the sake of emphasizing the other; it is necessary only that distinction between the two should be kept in such a manner that there will be no confusion.

CHAPTER VIII

Pictures, Models, and the Globe

One of the first things that comes with educative processes, as we ordinarily understand them, is the art of interpreting thought from arbitrary symbols. Alphabetic reading is an example of such conventionalization, and probably the most difficult task that the child encounters during the period of infancy. But conventionalization and symbolization seem to be an inborn trait of the human family and, in a way, mark a distinction between the reasoning powers of human and brute life. Moreover, the conventionalisms of the child go hand in hand with certain operations of the imagination, and therefore they deserve an important place in education. A piece of stick wrapped with a bit of colored rag may have scarcely the faintest likeness to the human form, nevertheless, in a way, it may symbolize; it is a conventionalism, and the imagination does the rest. Under the power of an imagination, more or less vivid, the paper tinsel doll becomes a real king or queen with a grand retinue of courtiers; the snow fort is an impregnable fortress, and responsibility would not rest more heavily

on the shoulders of the commander were he repelling an actual invasion.

Granted that these are extreme cases of the operation of the symbol and the imagination, yet there is hardly an instance in which a conventionalized form is used that the imagination does not play a part; indeed, there is scarcely a letter of the alphabet that is not fixed in the memory because the imagination, as an intermediary, erects it into a form of some kind or other. Thus, a certain child could always tell the word "beautiful" by sight because she pictured it as a butterfly; another never failed on "throughout" because his imagination associated it with a cable chain! These, of course, are cases out of the ordinary, but they illustrate the close connection between the imagination on the one hand and symbolization and conventionalization on the other.

Symbolization, with the employment of conventional signs, has a very important place in geography teaching, and in presenting the subject three forms of conventionalization are employed: descriptive text, maps, and pictures and models. Of the three forms, perhaps the greatest reliance is placed upon the descriptive text; and because verbal description covers such a wide field of possibilities, one is apt to give the first place of importance to the text. Certain it is that not many teachers could get along profitably without the text; it is there that one must

find the logical and systematic development of the subject. Not only this, but from the educational standpoint the great value of the subject lies in the selection of the material; indeed, the crucial test of the value of a *text-book* of geography is not so much what it contains as what it doesn't contain. A text in which the fundamental principles have been scuttled and sunk in a sea of irrelevant details may have a cyclopædic value, but it is not worth much as an educative factor.

Verbal description has its limits, however, and neither the most skilful teacher nor the most vivid writer can go beyond them. No one would think of attempting to teach even the most elementary forms by any except an objective method. Verbal description may and does differentiate between a square and a circle, but the words of expression merely *record* the difference, they do not *present* it; the presentation must be made by a visual study of the form itself. So, too, verbal description is incompetent to present color distinctions. Possibly a philosopher might indicate the difference between red and green by writing the figures of the wave-length of each color, but no one would be able to get much benefit from color study were the lessons taught that way; nothing but the colors themselves will appeal to the intellect, and none but objective methods will bring tangible results in such a case.

The same deductions, apply with equal force, in the teaching of geography. There are many, very many occasions in which verbal description is incompetent to convey the ideas by which an image of the form or the thing may be conceived. Unfortunately word-*ideas* are not always word-*pictures*, and so oftentimes the mind must seek the image in the conventionalized form,— the picture or the model. Pictures are frequently employed to portray the physiology of human passions, and from a historic standpoint their value for this purpose cannot be too highly appreciated. It is not much of an exaggeration, however, to claim that a very large minority, if not a majority, of pictures are either expressions of geographic form or else of the activities resulting from geographic environment.

Most teachers are fully alive to the teaching value of pictures, and the picture scrap-book has come to be a recognized part of the equipment of the geography teacher. So great is the demand for pictures having geographic value that at least two publishing houses make the trade in pictures their chief business. The free use of pictures cannot be too highly commended, for they enable the pupil to do not a little laboratory work that has, perhaps, quite as much value as though it were actual field work.

A great collection of pictures chosen haphazard, however, possesses but little value; and, in general, unless the teacher has a definite idea as to the specific

use of a given picture, the latter is worth but little. It is the work of several years to make a useful and usable collection of pictures, and then perhaps half the number collected will be discarded either because the teacher gets more crystallized and definite ideas concerning their use, or else better subjects can be found to take the place of those discarded.

To suggest a list of subjects would be wholly out of place in these pages. A collection suitable to the wants of one teacher might not and should not be of any great use to another. It should represent, not the fad of some method fiend, but the individuality of the teacher. The pictures themselves should represent, not what the principal or the school board think proper, but the pictures she can use the best. There are, however, a number of general principles involved which either directly or indirectly must govern all collections.

In the first place, the fundamental principles of geography concern topographic forms and climate; the results of these are the specific forms of organic life now existing and their various activities. The pictures therefore should include, first of all, good illustrations of geographic forms, both vertical and horizontal. For primary work it is essential that these should be of the very simplest character. Anything that detracts from the principal feature serves to confuse; therefore, a picture lacking in clearness should be discarded. Alpine mountaineers recognize some score or more of forms of

mountain peaks; but a child seeing the whole group of them would scarcely recognize more than two or three forms; therefore, in primary work, two or three types, in all about a dozen examples, are sufficient. With more advanced pupils, however, there will be but little difficulty in distinguishing between the peaks, the domes, the cinder cones, the projecting cliffs, and the mesas; therefore these types may be profitably studied in detail at the proper time and place.

Because they are great wrinkles or folds in the strata of the rock envelope, mountain ranges are fundamental features of topography. Models and photogravures of models will often give a better idea of the relation of mountain ranges to the continents, whose surface they diversify, than can be obtained from pictures. It must be borne in mind, however, that while the model or the photogravure shows the general relation of a system to the continent, and of the mutual relation of the ranges of a system, it does not correctly show the details of mountain scenery, and it fails to show their character at all. Such details as the inter montane valley, the transverse pass, the various forms of the crest, the hogbacks, and the cañons are best studied from pictures. Good pictures of mountain scenery, that show something more than one slope of a range, are not always to be obtained at a moment's notice, but fortunately most of the modern text-books contain fair to excellent illus-

trations. For primary work only the simplest illustrations should be employed. With intermediate work there should be illustrations which show some of the elements of structure, if possible; and in advanced classes both structure and the effects produced by degradation ought to be presented.

Topographic forms are greatly modified by climate. Arctic forms are unlike those of the tropics, and the landscapes of arid regions are wonderfully unlike those in regions of bountiful rainfall. For advanced pupils, therefore, the specific scenery of each kind of region should be so thoroughly studied that the pupil will readily recognize the character of each. Once the difference in the character of the Appalachian and the Rocky Mountain scenery is brought to the attention, there will be no difficulty in recognizing each with a casual glance. Tropical regions, whether arid or fertile, usually show their character in their vegetation, and Arctic coasts are almost always recognizable by the presence of ice or by the form that snow and ice have given to the surface.

The morphology of coast outlines is an important feature in geography because of their bearing upon human activities. In presenting these the same cautions should be observed with immature pupils as has been noted in other cases: select the simple and clear types, and take only the most general forms. In many instances the map will prove quite as practical

as the picture, even with primary pupils. One might find a picture of a peninsula, a bay, a strait, or an isthmus, but in most instances where these are shown they are bogus. Their made-to-order character is very apparent, and too frequently they are pictures the like of which does not exist in nature. There are other coast outlines, however, that are best shown by means of pictures. Even the youngest pupils must be taught something about the character of shore lines, and it is well to present pictures of the cliff-girt coast, with its long, unbroken wall, the rock-bound coast, with its multitude of islets, and the low, sandy coast hemmed in by wave-formed spits and barrier beaches. With primary pupils it is neither necessary nor wise to classify them, but even without classification they are none the less instructive.

The explanation of physiographic processes also demands the frequent use of pictures. In a great many cases the child must depend very largely upon them for illustration. Illustrations of erosion, corrasion, ox-bows, and deltas may and should be studied by observation, it is true; but knowledge thus obtained must be broadened by the inspection of pictures, maps, and diagrams. The same is true in studying other features of degradation, as the work of the wind in forming dunes, or that of vegetation in breaking down rock cliffs. Even where these things may be investigated directly from nature, pictorial illustrations of similar

character are exceedingly helpful. The trained scholar does not hesitate to use them, regarding them always for what they are worth — and they are worth a great deal.

Life and its activities include a very diversified range of knowledge, and here again one must rely upon conventionalized forms. It is necessary to have at least a theoretical knowledge of the various races of mankind and their institutions. Verbal description, however vivid, gives not only an unsatisfactory, but an incomplete, knowledge of the subject; so the picture must help to complete the idea. A certain amount of knowledge about animal life is demanded of every intelligent person, and it is a singular fact that most children are better acquainted with the wild animals of the jungle, the forest, and the desert than with the people of those same regions. There are but few boys and girls of ten years who do not possess a surprisingly large knowledge of the lion, the tiger, or the elephant;[1] yet scarcely one of them could distinguish a Bedouin Arab from an East Indian or a Malay. All this goes to show that the possibilities of teaching by means of pictures are very great; it also demonstrates the fact that we do not always accomplish the results that in some other way may be reached with ease.

[1] Perhaps, as a rule, they know these better than the wild animals that possibly may be in their own neighborhood; the former they have learned from the illustrated picture books.

The social institutions of the peoples of different parts of the world are as characteristic as their faces. Almost instinctively the mind seeks the knowledge of how people live, what they do, and what they wear. The garb of a Chinese, a Japanese, an Eskimo, an East Indian, an American Indian, or an Arab is each so specific that one may usually distinguish the race by the apparel. The character of the garb, and of the employments as well, is also a very useful key to determine the grade of the civilization. In work of this character it is needless to say that good pictures afford about the only means of objective teaching at the command of the teacher. A certain amount of "laboratory" work to test the extent of the pupil's observation is never a waste of time, and in this sort of work pictures are absolutely essential; descriptive reading may take its place, but the latter cannot be made a substitute for picture study.

The study of industrial and economic geography opens a field so vast that to enumerate the subjects of essential illustrations would be an endless task. No particular word of advice needs be given beyond a general direction to use pictures when the descriptive text does not convey a specific and distinct idea. In general, a picture that does not show a specific thing, the knowledge of which possesses training value, has no place in a working collection. Thus, a picture of a cotton mill, which shows nothing but a building with a smokestack,

may be truthful, but it has the minimum of educational value. On the other hand, a picture of a spinning-jenny, which spins one hundred and fifty threads in less than one-third the time the old-fashioned wheel required for a single thread, makes an excellent object lesson to show how and why the manufacture of cotton textiles has reached its enormous development in the United States. The picture of a header, or wheat-harvesting machine, that cuts a swath of thirty feet through the field, also makes a fine topic for an object lesson when compared with a view of "cradling" the grain. What better way could there be of demonstrating at least one of the reasons how and why the price of flour has dropped from more than ten dollars to less than half that sum per barrel!

Then, too, there are many words that in common conversation are very loosely used. For instance, the word "ship" is employed to designate about everything that is propelled by sail power; yet the distinction between a ship, a schooner, a sloop, a brig, and a bark is so readily learned from pictures that there is no excuse for a misuse of the terms. Steam crafts for ocean navigation are so different from those plying on rivers and littoral waters, that not to know the difference between them is to be ignorant of things that are helpful. The evolution of fighting vessels has brought into use many new terms, such as "cruiser," "battleship," "torpedo boat,"

"tender," "transport," "turret," "ram," and a host c others; and it is necessary to use these intelligentl) Therefore, picture study becomes imperative in distir guishing them, because the great majority of peopl who use these words can learn their proper applicε tion from no other source.

Another conventionalized form is the topographi model or relief map, the normal place of which hitł erto has been somewhat uncertain. Without doub the use of the model is indicated when a misundeı standing occurs with reference to the third dimer sion of space. Beyond this point, however, the idea of the proper place of the model and the mouldin board are vague, and the use of both has been unsat isfactory. The theories of the use of the model an the moulding board have generally come from educε tional writers who are not primary teachers, and wh have had no training in the science of topography The alleged "educational" models, a few instance excepted, have been devised and constructed by peı sons who have no knowledge of topography what ever; on the other hand, most of the relief map that are good are ill adapted for ordinary schoc work. As a matter of fact, the intent of the elabc rated relief map is to show *character* and *structure* — sometimes one, sometimes the other, sometimes both For instance, the Davis models are designed to shov the evolution of certain forms. They are severel

plain, but to the student of physiography they are valuable in the highest degree. It is hardly necessary to add that they have no place in primary work. The models which have made the brothers Mindeleff famous are remarkable for the manner in which they show the *character* of the topography, and in this is their great value. The same feature marks Mr. Howell's models also.

Some of the topographic models are grotesque in this respect. One enterprising New York publisher secured the services of a Swiss artist whose efforts resulted in relief maps that were reproductions of Swiss topography — Europe, Asia, Africa, and the Americas were all articulated bits of Alpine crags and Interlachen plains. In another instance the model of North America presented a Rocky Mountain system whose eastern slope extended to the Atlantic, and on the lower part of its flank were erected the Appalachian Mountains. It is fortunate for all concerned that such things have had their day, and a matter of greater congratulation that but few pupils ever used them.

In the place of the elaborate model there has come the practice of using the photo-relief, binding the latter with the pages of the book. The photo-relief, on the whole, answers the purpose admirably, and a set of such reproductions is found in nearly every primary text-book. Their stereographic effect is marked, and

whatever may be lost in detail is more than gained by convenience and availability.

Neither the model nor its photo-relief, however, can take the place of the sand moulding-board. This apparatus has been commended in very roseate terms by some teachers, while its usefulness has been disparaged by others. Perhaps when there has been an attempt to carry on an elaborate and systematic course in sand-modelling, the work has been barren of good results. On the other hand, when the moulding-board is used in the same manner that one would employ a blackboard, it has proved a most serviceable piece of schoolroom apparatus. One must bear in mind that the successful use of any sort of school apparatus implies not only an intelligent knowledge of the subject, but also definite ideas as to the purpose for which the apparatus is to be used. One must bear in mind, however, that the form moulded on the sand table is strictly conventional and wholly without character: to show the latter the teacher must resort to the picture, or, if possible, to the form in nature.

There comes a time, too, when the pupil must face the problems that are involved in the consideration of the earth as a whole — such, for instance, as the rotation of the earth, the distribution of land and water, and some of the problems of mathematical geography. Now the teacher may approach these problems in two ways — by using the flat map or by

making use of a terrestrial globe. In the latter case, however, the pupil is very apt to go through life with a flat earth. And the reason is obvious: at the age when the mind is most sensitive to impressions, and the latter are the most lasting, the pupil is studying a flat instead of a round earth.

In many instances courses of study in geography are vicious so far as the uses of the globe are concerned, inasmuch as they prescribe work that cannot be done. In other instances no definite instructions as to what shall be the character of the work done in each grade. In the primary grades no difficult concepts should be presented. Practically but two or three things are required: the child must learn that rotation causes the succession of day and night; the relative size and position of the continents must also be studied until the mental image of them is clear. In studying the effect of rotation it is difficult to understand why a teacher should use an apple or a ball, when a globe is a part of the equipment of so many schools. Moreover, in almost every text-book the principle of rotation is illustrated, and the picture is a very good substitute if there be no globe. In developing this idea, common sense suggests that the mathematical geography should be limited to the matter of rotation and the incidental use of the terms "pole" and "axis." The definition of these terms does not belong to primary geography.

The main thing at this stage, however, is one that requires neither explanation nor demonstration — nothing but individual work on the part of the pupil. The latter must study the globe until the image of an earth with the continental land masses radiating from the north circumpolar regions is fixed thoroughly in the mind — so thoroughly that it cannot be forgotten. It is evident that this can be accomplished in one way only — a study of the globe itself as a miniature earth. It is equally evident, also, that for this purpose the large globe, mounted on a tripod, has no place in primary classes; for such an exercise a small three or four-inch globe is necessary, and it should be in the hands of each pupil. The rest depends on the skill of the teacher. If the work of the latter be well done, there is no good reason why a pupil should go through life with a flat earth as the chief legacy of the geography course. A few years since, when the cost of school globes ranged from twenty to one hundred dollars or more, there was a reasonable excuse for its absence from the schoolroom; but now that good, serviceable globes six inches in diameter can be purchased for less than a quarter of a dollar, there is no reason why half a dozen or more should not form a part of the equipment of every primary school.

In intermediate work there are several exercises in which the globe is essential. The fundamental prin-

ciples of latitude and longitude are best studied from it, and so, too, the positions of the polar and the tropical circles, as boundaries of the light zones. In advanced geography, in history, and in economics the globe is occasionally necessary. Thus, the problems involved in the search for the Northeast and the Northwest Passage cannot be well understood when studied from the map, but they are full of meaning when one reads them from the globe. So, too, with the statement that recently appeared in a review, "The completion of the Nicaragua Canal will bring San Francisco nearer to London than Calcutta now is," has only an abstract meaning unless corroborated by an inspection and comparison of the routes on a globe.

It is scarcely necessary to add that the manual of instruction that frequently accompanies the globe has no place as a part of school work in geography. The problems are very good exercises in mathematical geography and astronomy, but they have no place in the grade work of geography.

CHAPTER IX

Maps and their Uses

Of all the devices for representing the earth's putative surface, the ordinary map is perhaps the most severely conventional. In the map every suggestion of perspective is either absent or repressed from the extremely arbitrary symbols employed. There must be conceived the correct mental images of coast forms, topography, and the various features resulting from human agency — rivers, mountains, lakes, bays, straits, oceans, and continents, each having its peculiar symbol either in form or in color.

There has been no little discussion about the proper interpretation of the conventionalized forms of cartography; but it is probable, so far as external form is concerned, that the image erected in the pupil's mind is reasonably correct. There are but few pupils entering the classes in which a text-book of geography is first used who have not fairly correct ideas of landscape and topographic features. Probably three-fourths of the pupils in the lowest grade of the public schools have correct ideas about the meaning of the terms "hill," "creek" or "river," and "pond"; a majority, too, have definite ideas of a shore, and know

the essential shore forms in fact if not by name. It is well to bear in mind that outside the general distinction of land and water not more than a score of forms are conventionalized, and almost always the general name of the form appears in connection with the specific name, as Hudson Bay, Isthmus of Suez, etc. It should also be remembered that, for the greater part, the map concerns only the localization of geographic features. Doubtless there have been instances where pupils have confused a map name with the form to which it belongs, but such instances exist more in the imagination of lecturers on methods than in the grade class rooms.

There are certain misconceptions, however, that are apt to come in the experience of nearly every instructor. The teacher who discovers that two maps of the same division, drawn on the same scale, differ in shape, at first most likely will conclude that one or the other is inaccurate. As a matter of fact, both are inaccurate. Indeed, accuracy is the one virtue that cannot possibly belong to a flat map. A map may have *outlines* that are geometrically similar, or *areas* that are in correct proportion; but it cannot possibly have similarity and correct proportion at the same time — no more can one have a piece of pie and eat it at the same time. So in some maps the outlines are geometrically similar; in others the areas are in proportion, while the outlines are distorted;

in still others there is intentional distortion of both areas and outlines. In some instances the scale of miles can be used; in others it cannot. On some maps a great circle, or an arc thereof, can be drawn with the utmost ease; in others the curve that represents a great circle is so complex that it requires a mathematical training in order to project it. Accuracy, therefore, is out of the question, because one cannot put on a plane an area that is a part of the surface of a sphere.

A map must be consistent, however, and unless it possesses this virtue, it is worth but little. To be consistent, every feature must have its proper position, and this is determined on the map as it is on a globe, that is, every point must have its correct latitude and longitude. The parallels and meridians, therefore, are the essential and structural features of the map. They are the only "construction lines" that the cartographer uses, and no others are required. The science of map-drawing consists almost wholly in establishing the curvature and relative position of these lines; the charting of the details is a work that is more an art than a science.

The method of locating the parallels and meridians is called *projection*,[1] and there are more than a score of ways in which they may be projected. For maps

[1] For the various methods of projection, see the author's "Reproduction of Geographic Forms," D. C. Heath & Co.

of small regions it is generally desirable to have the proportion of areas preserved so that the scale of miles will be true on any part of the map. For this purpose Bonne's projection is commonly used for the maps of states, state groups, etc., in text-books. It conceives each hemisphere, that is, northern and southern, in shape much like a sugar loaf or dome. In some instances, where accuracy of proportion is not required, the hemisphere, northern or southern, is conceived to be a cone; the map, then, will be the convex surface of the cone, unrolled and laid upon a plane. The conic projection is sometimes used in the projection of maps of Europe and the United States. When a still larger area is to be charted — a grand division or a continent, for instance, — the slant height of the cone is changed at every parallel, making the polyconic projection. For maps of Europe, Asia, and North America, either the polyconic or Bonne's projection is usually employed. The former distorts proportion of area; the latter, outlines. For large areas crossed by the equator, such as Africa and South America, a slightly modified Bonne's projection, or Flamsteed's, is frequently employed, as it gives both fairly accurate proportions and outlines.

Almost every geography contains maps of the hemispheres, but the use for which they are intended is not apparent to every teacher. They are designed to show

the relative sizes and positions of the great land masses, both to the earth and also to one another. Doubtless there are many useful exercises that the teacher may base upon these maps, but manifestly its most important use is the one suggested. So far as possible the maps of the grand divisions should be on the same scale throughout the book; and even when they are, their comparison in the group, as they appear on the hemispheres, is helpful. But if the continents and their divisions are not on a uniform scale, then a careful study of relative size and position from hemisphere maps is imperative.

Another sort of projection, the Mercator, has likewise a very definite and useful place in class-room work. A casual inspection of this chart, however, shows that both outlines and areas are grotesquely out of proportion, while a scale of miles can be used along the equator only. It is evident, therefore, that the Mercator chart must be restricted to certain uses. This projection was devised by Gerard Kauffmann (or Krämer), the Latinized translation of which has given to it the name it now bears. It conceives the earth to be a cylinder, theoretically of infinite length. The convex surface of the cylinder unrolled upon a plane, therefore, becomes the map. The Mercator is intended primarily as a chart for the use of sailors. Its great merit lies in the fact that a straight line on the chart practically represents the arc of a great circle.

For track charts a slightly modified form is employed.[1] For all ordinary purposes, however, the distances between the parallels are laid off at convenience, and without reference to mathematical formulas.

The chief merit of the Mercator, so far as landsmen are concerned, is the fact that it presents a map of the earth with a continuous unbroken surface — a feature that is often very desirable. No advanced text-book of geography is complete without a track chart, for there never was a time when an intelligent knowledge of routes of trade was so necessary a part of education as at the present. For the graphic charting of all planetary features — the distribution of winds, rainfall, heat, life, etc. — the Mercator is the most practical map that can be used in a text-book. When teachers and pupils realize that it is designed for convenience in showing these features, and not for the geography of location, the question of distorted outlines and areas will no longer be a perplexity.

From the foregoing paragraphs it is evident that each kind of projection has specific merits and demerits, and that the true value of the map cannot be appreciated unless one understands something of the general principles of their construction. Of the four or five principal projections named, perhaps one in twenty is familiar with the name Mercator, while in

[1] Directions and tables for projecting this chart will be found in the author's "Reproduction of Geographic Forms," D. C. Heath & Co.

audiences aggregating more than one hundred thousand teachers, the writer has found scarcely one hundred who are familiar with the others. It would be unwise at the present time to advocate the teaching of the principles of projection in elementary schools; yet the construction of most ordinary projections is so extremely simple, and so fundamental withal, that at least a superficial study of the subject ought to be encouraged. For the teacher, however, an understanding of these principles is an absolute necessity.

There are still a few teachers of geography who go through the laborious process of working out "construction" diagrams that are to be memorized by the pupils. Just what is gained by such a plan is not clear. A construction diagram that would apply to a given area in one book could scarcely be used in the maps of another. If it is intended as an aid in producing an elaborately finished map, such a clumsy device is useless; it is also a confession of ignorance of the fundamental principles of map-drawing. If a finished map is required, the parallels and meridians must appear, or the map has no value. Moreover, these are the only construction lines needed, and the cartographer uses no other. There are a very few schools in which most excellent work in map-drawing is done, but in the great majority it is either very poorly done or not done at all. In the French, German, and English schools, map-drawing is infinitely better taught than

in the United States, and there is a general opinion that the time is well spent.

But in general the production of elaborately finished maps is not out of place. In almost every school there is an occasional pupil having an aptitude for mechanical drawing, and an inaptitude for the routine work of the class room. In such instances practice in the drawing of finished maps is not out of place. Only this — such pupils must be taught not only the construction of projections, but the technique of the work as well. They must be taught how to execute the hachures, the coast-charting, the lettering, and the coloring. And when all this is accomplished, when a map is produced that on its face has the ear marks of the amateur, what is there to show? Merely a copy, nothing original — only a map whose intrinsic value is exceedingly small. But the time is hardly wasted, even though the map itself may have little or no value; the training is worth a great deal, and if the teacher's work has been well done, the pupil has acquired neatness, precision, and thoroughness. And these are attributes that he will be likely to apply in the professional work of his life.

Map-drawing as applied to the production of the off-hand sketch map, however, has a very definite place in the class room. In this sort of exercise nothing but the rapidly produced outline is required, and in its execution not more than half a minute

or a minute should be permitted. To make a good, off-hand outline requires some training and practice —at first with the model before the pupil, and then from memory. In the preliminary practice it is well to keep in mind that the bold, rapid stroke of the pencil or crayon gives an outline much truer in proportion than does the slow, pains-taking movement of the hand, that is expressive of doubt. Indeed, the bold, free stroke is the secret of good proportioned outline. In accomplishing the memory work, that drudgery of geography, the sketch map is probably the teacher's most useful coadjutor. A great deal of brain energy oozes out at the finger ends, and when hand and brain are working in harmony, there is a result that is not ordinarily reached when the two are not correlated. When a pupil has made an off-hand sketch in crayon, and has named or indicated the various coast features, he has by that process memorized about all the geography of the coast that any intelligent person will ever be called upon to know. When, by a few strokes of the crayon, he has drawn or otherwise indicated drainage basins and divides, or has distinguished the highlands from the lowlands, he has memorized the fundamental features of continent structure. And when he locates the various "culture" features, that is, the seaports, markets, and various other centres of population, he has incidentally memorized the location of each in

doing so. If, then, the teacher develops the fact that those same human features are there because of geographic reasons, the memory work passes from the stage of empiric into that of actual knowledge.

There is another kind of exercise in map-drawing that possesses a high training value; namely, the graphic charting of geographic statistics. The statement that the wheat crop of the United States is more than half a billion bushels,[1] is one that carries practically no meaning to a child. If the statement were to read five million bushels instead, in all probability it would not be questioned. The reason is not hard to find; the number itself is so vast that its value cannot be comprehended, and the problem involves an experimental knowledge not very likely to be the possession of an immature mind. If, instead of an arbitrary number value, it is stated in a comparative form as, say, one-fourth the world's wheat crop, the statement has a much greater value. But not until one charts the principal regions of wheat-growing on an outline map of the United States, does the full meaning appear. Then it is seen that, the Pacific coast area excepted, the wheat crop is confined almost wholly to the northeast quarter of the country; similarly, it may be shown that the cotton crop is confined to the southeastern quarter. Is there a reason for this distribution, or did it merely happen

[1] In 1898 it aggregated 758,000,000 bushels.

so? Moreover, both the cotton and the wheat have practically the same limit in the west, and the same line is also the western limit of dense population. Can this also be the result of chance, or are there factors of climate and topography that fix these limits? To the student who will follow these questions to the finish, there will appear the fundamental principles which have led to the historical and industrial development of the country along the lines it has followed. These are likely to be disclosed when the statistics are charted on the map, but they will not otherwise present themselves. The historian, the statistician, and the economist resort to this method of graphic charting in order to understand statistics; why should not the class teacher? There are various ways in which this sort of map-drawing, or rather map-editing, may be applied. It covers almost everything involving the idea of geographic distribution. It applies to history, to economics, and to the distribution of every kind of product. All the more recently published geographies are full of suggestions concerning it. It is needless to say that, in pursuing the practice of charting statistics, the use of printed outline maps is a great saving of time.

There is still another feature about the study of maps that is quite as important as map-drawing; namely, map-reading. One sometimes forgets that every form or character on a map stands for a particu-

lar geographic feature, and that almost always there is something about it that is an index of *character*. Thus the ragged and frayed-out coast of Maine, or of Norway, is totally unlike that of the Netherlands or the southeastern United States. These marks are an index to the character of the coast. In the former, one finds the result of a rugged, glaciated surface sloping abruptly and subsiding below sea level; in the latter, a coast plain slopes so gently below tide water that the drag of the waves piles up long, narrow spits and barrier beaches. From the latitude, as expressed in the margin of the map, one may readily form accurate conclusions about the conditions of heat and cold, and from the same source one can generally decide whether atmospheric movements have an easterly or a westerly origin. From the position of highlands one may learn whether a given region receives the full impact of wind-driven rain, or is shut off from the sweep of sea winds. Aridity of climate is discovered in the erratic rivers that seemingly begin nowhere and end nowhere, and in the lakes without outlets. When one knows the limits of the tropical rain belt and its seasonal migration, there is no difficulty in finding whether a given region has one rainy season each year or two of them. One may also decide, with a fair degree of accuracy, whether a given region receives its atmospheric moisture from seasonal and periodic rains or from cyclonic storms. Indeed, there are but few of the general fea-

tures of climate that cannot be read as clearly and plainly from the map as from the text.

In order to put the interpretation of maps on a better and a more scientific basis, a new plan for the delineation of topographic features has been coming into use in the past few years. In the place of the hachures, which conventionally represent mountains, lines called *contours*, marking and connecting points of equal elevation above sea level, are used. The hachures, originally intended to show the shading of slopes, in latter years have degenerated into symbols more closely resembling the march of processional caterpillars. Even under the hand of the most skilful topographer they could represent nothing but ranges, ridges, and cliffs; the broad expanses of nearly level highland they could not portray, nor could there be any distinction between such highlands and the lowlands. Manifestly, the maps that were wanting to such an extent in essential features could have but little scientific value. And so the contour map came to take the place of one that had about reached the limit of its usefulness, when its chief merit was to designate political divisions in calico colors. Because of its superior qualities the contour map has become the map officially used by most of the European governments and by the United States. By the United States Geological Survey it has been brought to the highest degree of excellence and usefulness, and the topographic maps now being published

by the Survey are the finest specimens of cartography produced in the world.

The nature and scope of these maps are explained in detail in the catalogue which is sent to any one at request. In order to facilitate the study of maps Mr. Gannett, the topographer of the Geological Survey, has collected about a score of typical maps, and these are published under the name of the "Topographic Atlas." A descriptive text accompanies the atlas. The map sheets published by the Geological Survey are furnished free to chartered colleges and to public libraries; otherwise, they are sold at the cost of paper and printing, five cents each for single sheets, and in proportion for double and quadruple sheets. It is suggested that teachers provide themselves with half a dozen sheets in the neighborhood of the school, provided that the maps of the particular area have been issued. Among the most valuable maps for the schoolroom is the double sheet "relief map" of the United States, colored in contours.[1] In sending orders for these maps, remittance must be made in cash or money orders, as postage stamps and personal checks will not be received.

The Coast and Geodetic Survey likewise publishes a number of maps having great educational value; one of

[1] For a list of government maps having educational value, the reader is referred to "Governmental Maps for Use in Schools," Henry Holt & Co., New York.

these, New York Harbor, is suggested for the purpose of making pupils acquainted with the range lights, channels, buoys, channel markers, and signals employed as safeguards to navigation.

Another highly interesting map is that of the "Alluvial Valley of the Mississippi River," published by the Mississippi River Commission, St. Louis, Mo. It consists of eight large sheets, on a scale of five miles to the inch; price forty cents. It is a complete and a highly instructive map of the river from Cairo to the Gulf, showing the meandering of the stream and the cut-offs and ox-bow lakes. These maps show with wonderful clearness the physiographic characteristics of large rivers. A "Preliminary Map" of the Lower Mississippi, on a scale of one mile to the inch, is published in thirty-two sheets, under the authority of the Commission. These maps are also sold at five cents per sheet. One of these sheets, Palmyra Lake, formerly Palmyra Bend, is a very instructive sheet, from which the history of Davis cut-off may be read.

The teacher ought also to become familiar with the Coast Pilot Chart, and a series of the monthly charts for the year — or, at least, a midsummer and a midwinter chart — should be a part of the equipment of every physical geography class. These charts contain information about trade-wind limits, storm tracks, and sailing routes, not to be found elsewhere. Weather bureau maps should also be used from the moment the

pupils are old enough to interpret their meaning. There is no other department of geography so practical as weather observation, and pupils in the advanced grammar grades in some of the western schools are trained to make forecasts that reach a very high degree of accuracy.

But there is always the carping carper who at the consideration of this idea sounds the time-worn, dolorous moan, *cui bono*. Well, what are these publications for if not to be studied? They represent the observations and researches of the men who put a useless geography of the past on the plane of a useful science, and have demonstrated that commerce, sociology, and economics are in harmony with the man, only when they have been developed along geographic lines. Education is democratic, not aristocratic; and the work of the scientific departments of the government is for the people, not for the scholar. The conduct of these departments has but one end in view; namely, to bring more of prosperity and civilization within the reach of every one. To reject or to neglect the publications of these bureaus, therefore, is to deprive the pupil of rights that are guaranteed him.

CHAPTER X

THE COURSE OF STUDY

IN no other study of the public schools is the course of instruction so varied, so disconnected, and so illogical as that of geography. In the English and French schools it is, on the whole, decidedly superior when we consider results. In the German schools it is incomparably better taught, and the courses of study are far better. Until within a few years there has been a popular sentiment against the study itself, and in not a few instances have teachers of wide reputation prided themselves on their ignorance of the subject. Even at the present time there is a very general notion that the study of geography means merely the acquisition of a great number of names and locations. Latterly, however, there is an accepted notion that, instead of being "a description of the earth's surface," it should be "a description of the earth as the home of man"; but there is a lurking suspicion that the idea has more of precept than of practice.

Nevertheless there has been a most marked improvement in the geography teaching throughout the country during the last two decades. The individual teacher is

better equipped in the matter of geographical education; popular sentiment has been awakened; text-books are better; a few universities have provided summer courses for teachers; a dozen or more normal schools have provided trained instructors; and at least two leading universities have well-equipped laboratories and special departments of geography. What is still better, in many of the graded schools, especially throughout the Mississippi Valley, the principals themselves have taken the matter in hand, and have undertaken a careful and even a personal supervision of the study. All this is very hopeful, and it means that, in the near future, there will be no necessity to apologize for the geography teaching in the American schools; there certainly is at the present time.

Two things are very necessary to bring about better results; namely, better preparation on the teacher's part, and better courses of study. The first can be readily planned, but it will require time in which to carry the plans into effect. For the use of the teacher who cannot prepare, under a trained instructor, a definite course of instruction, field work, laboratory work and reading must be provided, and the examinations for certificates must be based on this work. It is doubtful if a provision of this kind exists in a single state. Ohio has a most excellent syllabus of geography, — certainly one of the best that has yet been provided, — but the use of it is compulsory in theory only; practically, its

publication has been a waste of good paper. The moral is obvious: if a suitable preparatory course for the instruction of the teacher is devised, its use for that purpose ought to be made mandatory, and the examinations for certificates should be based upon it.

Most certainly the pupils would profit by a better preparation of the teacher, but a source of still greater benefit ought to be sought in another reform; namely, better balanced courses of study. Doubtless these are coming in time, and perhaps it is wise to make haste slowly. To a certain extent the course of study has a temporary limit in the ability of the teacher. If such a course as is employed, say, at Weimar, were immediately put into force in any city of the United States, the results would be disastrous. The teachers would not be well enough equipped to carry out the work as it is prescribed; the pupils would be ill-prepared to receive it. Such an elaborate course is the result of slow growth; both time and local conditions are required to give it real value. In Weimar and Leipzig the course of study covers ten years, extending from the grades corresponding to the intermediate, through the high school course. Or if the student after taking the course of eight years in the elementary school elects to enter the normal school, there is a course of six years, fourteen years in all, before him.

Against this a pupil in the schools of the United States, after three years of "nature study" in the pri-

mary grades, begins the systematic study of geography in the fourth year of the elementary school and finishes it, usually in the eighth year, but very frequently in the seventh. In both the German and the American schools the time varies from one to two and one-half hours per week, the average being a little less than two. In the schools of the United States the subject is again taken up for about half a year, or, perhaps, a full year in the high school, under the name of physical geography. It is also studied in the normal schools, but generally with reference to method, the academic work not differing materially from that of the elementary schools. In the American universities there are occasional courses that are incidental; in but two or three are there systematic courses. In the German universities the courses are elaborate, and there are but one or two in the whole empire without a chair devoted to this science.

Out of the chaotic state from which geography teaching in this country has been emerging, there are gradually taking form courses of study that in time will develop into most excellent schemes for better instruction in the subject.

By common consent, the first three years of work is devoted to nature study, much of which is observational geography pure and simple, or else is closely akin to it. This arrangement is practically one of necessity, for, until the pupil has learned to read, observational study

is the only work that can be done. This sort of work should not be limited to the primary grades, however; it should be carried on throughout the entire course. In another chapter there are given general outlines from which a systematic course may be elaborated.

In most courses of study, descriptive geography very properly takes the first place of importance during the fourth, fifth, and sixth years. During this period the pupil becomes acquainted with the various peoples and places of the earth, and in this time probably most of the memory tasks are mastered. During these years, too, there is presented, not only an earth of continents and oceans, but also one of planetary features. As to which one of these ideas logically takes precedence depends upon the judgment of the teacher. The subject is one upon which alleged experts have spent years of wrangling, and the solution must be left to the pedlers of method fads. A sensible teacher will adopt whichever plan he can best use.

In the last two years of the course (if eight years be given to the study) the work takes an additional factor; namely, the *industrial* or *economic* side. That is, the study of peoples and places is broadened until it includes the employments and products as well. The two last, the pupil will learn, are direct results of environment, that is, of climate, topography, and position. In the closing years of the course in the grammar school there should also be plenty of descriptive and

observational work, the latter mainly field exercises, but the economic side should take the first place in importance.

In quite a number of schools, especially in the cities, there has been a disposition to close the course in geography at the end of the seventh year. A more inexcusable blunder could not be made; were the cut in time made by omitting geography in the fourth year instead of the eighth, the effect would not be half so bad. The problems involved in the modern aspect of geography are far too difficult to be met by seventh-year pupils. Many of these problems require maturity of mind that comes only with years, and they are best undertaken after the pupil has reached the high school. The advocates of what is sometimes termed the "new geography" insist upon the correlation of geography with the various economies of life; yet many of them have deliberately cut off the study at the very time when its educational value can be appreciated.

The position of physical geography is somewhat anomalous; in fact, it would not be far out of the way to say that it has no position at all in most schools. In many high schools it is placed in the last year of the course, after the pupil has completed the work in botany and zoölogy. Now, these studies are intimately related to geography. The distribution of life, and in many cases the external and structural forms of the individual, are resultants of geographic envi. onment. They will be

best understood, therefore, after a good course in physical geography has been completed, and not before it is undertaken.

Until within recent years the study of physical geography meant merely the study of fixed, unchanging forms. Then there came a period when the physiographic side was brought into prominence, the genesis and evolution of the form being studied in detail. This was a very great stride in advance. But not only does every geographic form leave its imprint on the economies of life; in many instances it determines those same economies, making them possible or impossible as the case may be. In view of this fact, the science of physical geography latterly has grown to be three-sided; namely, the physical form, its operation or evolution, and the consequent bearing upon life. Most of the problems of geography when studied from this threefold aspect are within the intellectual grasp of high school pupils. But unless this third side, the application of the principles to life, is emphasized, the study does not reach its full value.

There are many excellent courses of study in geography now in use, but in general they have been overloaded instead of enriched, and therefore they are not well balanced. In many instances, if the course as planned could be distributed through eleven years instead of eight, they would be far more efficient. The fact that an overloaded course cannot be digested

and assimilated ought to be apparent, but evidently it is not; and this is the chief criticism against many of them. Local conditions must largely determine the character of the course, and for that reason, an attempt to present a model in this chapter would be manifestly out of place.[1] A course that would be well-nigh perfect in one locality, might have but little value in another. One thing, however, is certain; experience and experiment are both necessary in making an effective course of study. A good course cannot be formulated without experience as to the needs of the locality; moreover, it must evolve gradually. Experiment will determine the what; experience will demonstrate the question of fitness.

And having provided a suitable course, there comes a still more difficult matter: the superintendent and his principals must train the assistant teachers to the use of it. The general training that the teacher may have received in the academy, the normal school, or the university will be invaluable, but it will not take the place of the local work. For this, a certain amount of field work and special reading are essential. They should be made obligatory, and they ought also to be carried on under the supervision of a competent director.

[1] For an excellent example, the reader is referred to the course prepared for the public schools of Stockton, Cal.

CHAPTER XI

Observational and Field Work

One of the best features that has come into modern methods of education is the disposition to stimulate the observational powers of the child. In the times now happily going by, the child was a secondary matter — something on whom the psychological presentation of a given subject was to be practised, the main thing being the method by which it was accomplished. As a rule, the child was a passive entity — a sort of receptacle into which a measured amount of graded and useful misinformation was to be ingested. Outside of the practice work in writing lineal miles of equations and reducing fractions to uncommon denominators, there was but little chance for the child to cultivate his activities: indeed, beyond his sporadic outbursts of mischief, it was apparently forgotten that the child possessed intellectual activities.

Even in the study of the sciences the activity of the pupil usually did not go beyond seeing what the instructor did. In botany it was the teacher and not the pupil who pulled the flower to pieces — and incidentally it seemed that the plant had no other mission than to be dismembered — the pupil merely

looked on, or was supposed to do so. Or, if it was to be determined whether a leaf was lanceolate or sagittate, the fact was as likely determined from a picture of a leaf as from the leaf itself. It rarely occurred to the teacher that the synthesis of a plant was more important than its analysis. Only the Sissy Jupes ever discovered that there was an ethical side to the plant, and that its wholeness was of greater value than the aggregate of its pieces.

In mineralogy the pupils were expected to know something about the systems of crystallization, and frequently they were required to memorize the chemical formulas of various minerals; it was necessary to know that quartz was SiO_2, but to require one to select a piece of quartz from a number of minerals was scarcely less than an imposition.[1] A pupil ten years of age may easily learn the blow-pipe reactions of all the common ores of the economic metals and of many minerals, but it is only in recent years that any attempts in this direction have been made.

In zoology the instruction was even more meagre; the pupil memorized the classification of animals, and probably remembered that they were divided into birds, bugs, beasts, and batrachians. The idea of a biological basis in the study of zoölogy and botany in the main, however, was considered preposterous, and laboratory

[1] This experience befell Dr. Emerson E. White, when a student at college.

work was scarcely dreamed of. About the only redeeming feature of the work was the fact that many pupils became interested in shell collections.

In geology the chief end of the study was a memorizing of the order of strata, and the learning of the names of fossils. The redeeming feature in this case, too, was the collection of the fossils of the neighborhood. Dynamic and physiographic geology were very gingerly handled, and in general it was thought that the whole subject was born of the devil. Physical geography was looked upon as a useless luxury, and in some cases the study was put under the same ban as geology.

Now, in the course of time, it came about that the science teachers of the secondary schools, and not a few of the colleges, were drawn from the young men and women whose preparation for their work covered about the same ground noted in the preceding paragraphs; and the surprising thing about it is the fact that, from the theoretical side, they knew their subjects pretty thoroughly. Much reading had made them familiar with everything save the knowledge that comes with objective study.

But when the students, who had prepared under these teachers, entered the university and had reached the place where they were compelled to get information first hand, that is, from sources other than books or the teacher's stock in trade, there came in the course of each a deadlock. As a result, there was the choice

between failure, and the extra work required to cultivate faculties that hitherto had been dormant; namely, the faculties of seeing and interpreting.

In the long and somewhat bitter discussions that were brought about by this state of affairs, there was one thing that the university never failed to demand; namely, that the faculty of observation should receive cultivation as well as that of memory; indeed, this is one of the few reforms in education that have come from the university and not from the elementary school. Thus it has come to be recognized that the knowledge a child gets by discovery is worth far more than that which is obtained by word of mouth. And so the demand for observational work which started within the university reached downward step by step through the grades of the high and grammar schools until it occupied an established and fundamental place even in the curriculum of the lowest primary work.

The observational work called, perhaps unwisely, Nature Study is now a recognized feature in almost all schools. Granting that in the hands of novices and poorly trained teachers there is more or less wasteful, injudicious, and even ridiculous work, the results, nevertheless, have been distinctively good. Even were one to assume that errors of statement, wrong conclusions, and bungling methods marked every step, the work would still be beneficial, simply from the fact that the pupil is enlarging his powers of observation and is be-

coming a discoverer. And inasmuch as that will be the sort of work expected of him in life, why not prepare him for it in the school? The reading method might fit a young man to be a private secretary; the discovery method fits him to be the employer of private secretaries. Anything that gives one self-power to discover and acquire knowledge is good; anything that gives the teacher self-knowledge in the place of a reading acquaintance is equally good. There is a wonderful strength that comes from the knowledge of contact; it is as solid gold compared with paper tinsel.

Now it has come to be a pretty well established principle that botany, zoölogy, mineralogy, physiography, geology, and, to a slight extent, chemistry and physics, have a geographic basis. In general, we may call them differentiated geography. Animals and plants depend for their existence on conditions of environment that are distinctly geographic. Indeed, it would not be a very great breach of the truth to claim that a fish is a fish; a bird, a bird; a lizard, a lizard; or even a camel, a camel; or a seal, a seal, solely because of its geographic environment. If there were no creeks, ponds, and impounded waters, there could be no ducks; were the atmosphere composed of hydrogen, birds would of necessity require an expanse of wing fifteen times as great as at present; or if the air were one hundredfold denser than at present, the wings would become fins. There is but a single degree between the fish

and the bird, and that is the density of the medium in which it moves.

All nutrition is derived from the earth. Moreover, in studying other life forms, we are studying the things that are essential to the life of mankind; and we cannot study them logically without making geographic environment the basis of research.

But it is evident that only a very few facts in the study of life forms can be appreciated, and only a few laws can be understood, by the younger pupils. It is manifestly unwise, therefore, to attempt any sort of work that cannot be assimilated. Judgment on the part of the teacher, therefore, is requisite in knowing what to select and what to omit in each of the various grades of work.

The study of rocks and minerals also is very closely related to the work of geography in the grades, and it is well to emphasize that the coarse fragments of rock waste as they are borne downward, are ground finer and finer. At last, by admixture with vegetable matter, and through certain chemical changes, they become the soil that yields its nutrition to life. Rock-formation can be illustrated by means at the command of every teacher. Furnace clinkers show the principles by which most igneous rocks have been formed, and sand or fine clay shaken in a glass with lime water shows the process by which sedimentary rocks are formed. If pupils are taught to identify clay, slate, limestones,

and marble, sandstones, lava, basalt (or trap), and granite, they will have a fair working knowledge of about all the economic rocks with which lay people need to be familiar.[1] Of these, from three or four to a dozen specimens should be studied, and the study should include not only the question of the identification of each, but also its economic use.

A rather more extensive knowledge of minerals is advisable, and these, on the whole, are more easily identified from their physical appearance than are the rocks. The specialists in science excepted, there are few men and women who require a working knowledge of more than thirty mineral species.[2] In one way or another, most of these enter into the affairs of life. All but half a dozen can be recognized by their physical properties, *i.e.* color, hardness, streak, and lustre; in the great majority, moreover, the blowpipe and humid reactions are so exceedingly

[1] The most difficult to determine are the highly metamorphic rocks that precede those of the palæozoic era.

[2] Nearly all of the following are readily attainable for purposes of study: —

Diamond	Turquoise	Sulphur	Cannel coal
Ruby	Hematite	Asbestos	Lignite coal
Sapphire	Magnetite	Talc	Flint
Emerald	Pyrites	Mica	Carnelian
Garnet	Franklinite	Felspar	Quartz crystals
Amethyst	Argentite	Anthracite coal	Sea sand
Opal	Malachite	Bituminous coal	Agate

simple that the determinations can be made with certainty by pupils in the grammar grades; a comprehensive knowledge of chemistry is not needed in order to make them.

It is hardly necessary to add that local conditions should govern in the study of minerals and rocks, and that first place should be given always to the species of the locality. A moment's thought will convince one that the presence of any one of the species noted, in workable quantities, has much to do with the industrial, and therefore the historical, development of the locality; thus, the discovery of iron in the southern Appalachian Mountains created both a social and an industrial revolution in the locality; similar results followed the discovery of the precious metals in the West, and that of copper and iron in northern Michigan.

In the ordinary work in geography there are abundant opportunities for very practical laboratory and field work. During the first years the nature study provided in the courses of most schools makes a most excellent beginning to the systematic study of geography, and in general it is the medium through which children will best learn to appreciate geography. Incidentally most teachers will discover that the pupils who find great difficulty in book study are apt to be the best observers and most independent thinkers in field work. During the third year the geographic side

of the nature study may be emphasized, and a certain amount of systematic work may be undertaken. The amount and character of this, however, must be governed by local conditions, and the discretion of the teacher should determine both the character and the amount. In the following paragraphs the topics are in the light of suggestions; they furnish abundant material for individual work, but it goes without saying that the outlines given should not be slavishly followed. From these outlines, however, a good working course adapted to almost any locality may be prepared. The book work for each year must be governed by the requirements of the course of study.

WORK OF THE FOURTH YEAR

In the fourth year, about the period in which the text-book is used for the first time, the field work should be made systematic, taking the topics that commonly are included in "home geography," that is, the geography that may be studied in the vicinity of the home and the schoolhouse. For individual study the investigation of the things that may be observed about the pupil's home should be encouraged; for class work the topics are best suggested by the school grounds. In general, the home work should be assigned by the teacher. At first, accuracy of work and correctness of results should not be expected. The first result to be obtained is a cultivation of the pupil's self-reliance, and the chief part

of the teacher's work is to encourage and not discourage. The following topics will not be too difficult.

Position and Direction. — Discuss the position of well-known objects or places in the vicinity, so as to lead to the need of a knowledge of direction. This will gradually suggest such topics as the sky line or horizon, noting that the horizon changes as one goes from place to place; position of the sun on the horizon at sunrise; at sunset; east, the direction toward sunrise; west, the direction toward sunset; develop "north" and "south" from their relation to sunrise and sunset; let the pupils discover the direction of the noon shadow; require a list showing the direction of well-known objects or places from the schoolhouse and thereby show the needs of intermediate directions, as northeast, southwest, etc. Encourage the pupil to establish the direction of well-known objects from his home. Local excursions or walks should be encouraged, and a sketch map should be made showing the direction taken and the principal objects on the right or the left of the road or path.

In the foregoing, as well as the succeeding individual work, do not expect great accuracy at first; that comes only with experience and time.

Distance. — The measurement and estimation of distance during the year should be governed more or less by the work in arithmetic. It may be assumed that pupils doing fourth-year work are familiar with the ordinary units, the inch, foot, and yard; a brief test of

the matter may be advisable, however. It is needless to add that the laboratory results, that is, the ability to estimate closely, is the most important part so far as geographic work is concerned.

The general trend of this topic should be distinctly geographic, leaving the question of compound numbers to the arithmetic class. Pupils should become acquainted with the mile and its subdivisions in a general way. In most cities the blocks or squares make convenient standards by which to estimate the mile, and in the country section-line roads are one mile apart. As a general suggestion, objects one mile apart will furnish the most impressive and practical illustrations.

In the latter part of the year's work a few easy lessons in making maps on scale may be attempted; they should be of the most elementary character, however. It is very easy to go beyond the pupil's ability to understand problems of this kind, and such a mistake, of course, would be fatal to success.

Globe Study. — Whatever of mathematical geography is undertaken at this time — and pratically but very little is needed — should be done with the globe. A knowledge of the causes that result in the succession of day and night is essential, and the explanation of them involves a knowledge of the terms "pole" and "axis."

When the pupil becomes acquainted with the distribution of land and water on the earth, this should

also be learned from the globe, and it should be taught so thoroughly that the pupil has a mental photograph of the outlines of the great land masses, and their relative size and position. When the principal features of outline are studied, the necessities of relative position and direction are manifest, and so parallels and meridians are drawn upon the globe in order to determine position. (*See also Chapter VII.*)

The pupil has already learned that there are some places on the earth where it is always warm; others, where it is perpetually cold; and still others in which periods of warmth and cold alternate. These localities, it may now be learned, form zones of climate. In bringing out this fact it is not necessary to assume that the zones are bounded by the polar and the tropical circles, for they are not. It is not necessary to learn anything about these circles unless the course of study stupidly makes it mandatory. The inclination of the earth's axis should be shown incidentally, but it is not necessary to worry about the plane of the ecliptic.

Weather Study. — It is a good plan to carry on regular weather observations, and the pupils should become familiar with dew, frost, fog, cloud, etc. The artificial formation of dew is always an interesting experiment, and the latter should be repeated until the pupils are satisfied that the moisture does not come from within the freezing mixture. A mixture

of salt and ice, or ice alone, in a covered vessel of polished metal will illustrate the principle. A tin cup is far better than a glass tumbler for the purpose.

For most of the work of this grade it is the observation of facts and not their explanation that is required. The fact that dew may result from the chilling of the atmosphere is essential, but the explanation is not, nor can it be, understood by fourth-year pupils.

During this year a simple weather record may be kept, and a public record should be made by pupils designated for the purpose. The object, of course, is not the having of a record, but the practice of making it.

Field Work.—The field work should be adapted to the local conditions, emphasizing the topographic features that occur in the vicinity; those not within reach may be illustrated by pictures and by the use of the moulding board. Most of the horizontal forms may be found along the shores of the nearest body of water.

The problems and processes involved in drainage are illustrated in almost every school yard. With intelligent direction on the part of the teacher the pupil may be led to discover the results of cloud gathering and rainfall. It may not be wise to dwell on the details of percolation, transportation, and deposition, nor even to mention these names. The fact that the water of rain and melting snow gathers

into rills, brooks, and rivers, and carries rock waste to lower levels, should be thoroughly impressed, and this is best accomplished when the pupil discovers it by his own efforts.

The pupil should also become familiar with the soils of the neighborhood, and there are few localities in which sandy, clayey, and loamy soils are not found. The rocks of the vicinity should also be studied, so that they may be determined readily by their physical characteristics.

Economic Geography. — It goes without saying that the economic geography of the year should be devoted mainly to the products of the locality. If agricultural, where and in what way do they go, or is any intermediate process of manufacture required? If a manufacturing centre, whence do the raw materials come, and where is the market for the manufactured articles? If the locality is a centre of foreign commerce, the decks and holds of incoming vessels, and the docks at which the cargoes are discharged will yield a great fund of information.

WORK OF THE FIFTH YEAR

Position and Direction. — Review or test the work of the preceding year. Note the position of the sun's setting on the 20th of September, December, March, and June each, or on a clear day nearest these dates. Inasmuch as this is most conveniently done at home,

each pupil must note his own horizon markers. At school the length of the noon shadow may be measured on each of these dates.

In addition, the mutual relation of the earth's axis and the north star may be explained. The teacher may direct the pupils concerning the manner in which the pole star is found, but in general the pupils themselves should locate it.

Mathematical Geography. — Review the work of the preceding year, using the globe and such diagrams as may suggest themselves. In using the globe, habitually keep the axis pointing toward the north and at its proper inclination. Explain the use of meridians and parallels, and note the position of the prime meridian. Practically all reckonings are now based upon the Greenwich meridian — not from necessity, but as a matter of convenience. Teach the position of the tropical and polar circles if the course of study requires it, but omit the common error that they are the boundaries of zones of climate.

A few general comparisons of latitude and longitude should be learned at this time; for instance: Which is the farther west, Chicago or Valparaiso, S. A.? Is the greater part of South America north or south of the equator? Is the greater part of Africa north or south of the equator? Name the states of the United States that are near to or intersected by the 45th parallel; the countries of Europe; the comparative

latitude of Manila and Honolulu; of Cairo and New Orleans; the meridian distance between the eastern and western extremes of the main body of the United States, including Alaska. These and similar problems should be studied from the globe and not the map. The pupils should be taught to determine latitude and longitude from the map as an exercise in mechanical measurement rather than one of comparisons of latitude and longitude; for the latter the globe should be used wherever possible.

Map Drawing.—The most practical work in map drawing is the off-hand sketch made from memory. This, as has been explained in another chapter, is the most feasible and least expensive way of accomplishing the memory work of geography. Some of the elementary features of map reading may be undertaken. Use the moulding board or the model whenever the circumstances demand.

Out-of-door Studies.—Review the field work of the preceding year, taking as topics the topographic features of the vicinity. The pupil has already learned the names and character of the principal vertical and horizontal forms, and has also become acquainted with physiographic agents; the teacher may now direct the pupil's attention to the discovery of their mutual relations, that is, the fact that these forms are shaped largely by wind and by water in its various forms. The emphasis of course should be placed on the geographic features within the pupil's horizon. An understanding

of these makes the comprehension of other forms comparatively easy. In many instances effective laboratory work may be accomplished by the study of pictures.

WORK OF THE SIXTH YEAR

During this year the classes of most graded schools finish the elementary text-book. In general, it is an error of judgment to undertake the advanced book before the middle or end of this year; it is too difficult and is not intended for pupils of this grade.

Review the field and laboratory work of the preceding year, taking such topics in advance as may be comprehended. By this time the pupil should have discovered that geographic features are intimately connected with the activities of life; that level lands are best adapted to farming, good harbors to commerce; that manufactures concentrate at places where coal or water power is abundant, etc.

It is to be expected that pupils have become familiar with all the ordinary terms of geography; it will be well to discuss some of the following, including in addition the meaning or meanings of any terms that are purely local: ford, "wash," "dry run," "sink," pothole, current, channel, delta, estuary, bluff, flood plain, "bore," "slack water," etc.; peak, "hogback," "butte," divide, dune, pass, cañon, terrace, foothills, etc.; canal, dam, dike, levee, lock, ship canal, ship channel, buoy, range light, and others that may suggest themselves.

The study of forestry does not always have the attention it deserves, and the plan of a systematic observation of the more common trees is to be commended. The observations should include the time and manner of putting forth their leaves, the time of flowering and the character of the flowers, the character of the fruit and seed, the time of shedding the leaves, comparative and actual, and the various other changes that occur. Not only should a complete list of the kinds of forestry be made, but pupils should know the characteristics by which a tree may be named on sight. The observations on each kind should be at short intervals during the season of budding and leafing, and should extend until the leavcs are shed.

In general, the work of this and the preceding years should be qualitative, that is, in the work of *discovery*. The teacher will accomplish the best results when the pupils are so led that they learn the facts by their own research; and, as a rule, a pupil ought not to be told anything he can learn by his own efforts. The great value of the field and laboratory work is the preparation it gives the pupil for the systematic laboratory work of succeeding years.

WORK OF THE SEVENTH YEAR

Map Work. — The map drawing of this year should include the necessary training in the off-hand sketch maps that are needed for almost every recitation. For

the statistical work required, such as products, historical development, physical, and other features, etc., graphic charts should be constructed on about every possible occasion. If elaborately finished maps seem necessary in the judgment of the teacher, a map of the county or the township will be found a more practical and valuable exercise than one of a region with which the pupils are not likely to become familiar. If the pupils of each township were to prepare a number of township maps and exchange them with the various schools, each district school might then have the basis from which a very complete county map might be constructed.

Map reading is an important factor in geography study, and where contour maps are employed many of the facts now learned from the text — and as quickly forgotten — may be acquired by discovery. The pupils that have learned the movement of the heat belt north and south will readily judge by the latitude of the county whether it belongs in zones of perpetual cold, of perpetual warmth, or of alternating heat and cold. An inspection of latitude will suffice to show the wind belt in which the region is situated; and so, in general, the climatic conditions of a county may be easily discovered from the map.

The character of the coast shows whether the latter is adapted to commerce, or whether it is bordered by the spits and barrier beaches that forbid commerce. The contours of the map indicate whether the surface

is level or rugged, high or low. Extreme aridity of climate is shown by the earmarks already described in a previous chapter, and the earmarks are usually infallible. All these and many other facts should be learned from the map, afterward to be corroborated by the text. No cut-and-dried scheme or list of questions can be presented for this work ; the teacher's judgment should dictate.

Rocks and Minerals. — The work along this line should include a collection of the rocks and minerals, and a study of the soils of the vicinity when practicable. The pupils should be trained to identify both minerals and soil components by their physical properties, and they should also learn their economic uses. In the schools of the larger cities, the study of the materials used in buildings and road pavements will prove very practical object lessons. Other topics will be suggested by local conditions.

Animal and Vegetable Life. — The work suggested in these topics should include the collection of local specimens and such others as may be deemed practicable. The pupils should be able to identify the friends as well as the enemies of mankind. In the extermination of such pests as the codlin moth, the gypsy moth, and the tree caterpillar, school children have proved a wonderfully efficient factor.

In making and preparing such collections the work of the teacher should be directed in two ways : first,

to instruct the pupil in preparing and mounting the specimens neatly; secondly, in leading him to habits of accurate observation.

It is hardly necessary to add that the study of the commercial products of animal and vegetable life of the vicinity should be an important topic, especial attention being paid to their origin, manufacture, and ultimate distribution.

Physiographic Geography. — Review the work of the preceding year. By the use of pictures, diagrams, or other devices, develop the fact that mountain ranges are broken and greatly worn folds in the rock layers; that in most instances the intermontane valleys are the flood plains of rivers which have been filled with fine rock waste worn from the mountain slopes and carried into the valley by the rivers themselves. Impress the full meaning of such terms as "basin," "divide," etc., by directing the pupil to draw on the map a line around a river and its branches; it is in this way only that the real significance of these features can be obtained from the ordinary map. When necessary, do not hesitate to use the moulding board to aid in the illustration of topographic forms.

For field work it will be well to study carefully the physiographic features of the neighborhood. In following exercises of this character there will be no lack of material; even the large cities are full of examples of the work of running water, wind, and

vegetation. Many localities are famous each for a certain character of physiography: thus in New York and Boston the work of glacial ice is very impressive; in Chicago the work of wind in making sand dunes, and the combined action of wind and wave and ice in forming shore bars, is prominent; in Cincinnati the work of rivers in forming broad valleys and flood plains furnishes excellent object lessons.

Weather Observation.—In the weather study of this year the quantitative element should predominate; that is, the pupil should be taught to record observations properly, to make averages, to read the thermometer and barometer accurately, and to use the rain gauge.

EIGHTH YEAR

In the eighth year the work of the previous year should be tested and reviewed. By this time the application of physiographic and climatic features to life and its industries should be made the central point of study. In meteorology, the daily weather maps should be studied first with reference to the manner of their construction, and then as the means of making forecasts—an exercise by no means so difficult as it appears. When the pupil has learned that the storms of the United States (the tropical cyclones excepted) are preceded by easterly and followed by westerly winds, and that the storm area (or

area of low barometer) moves across the continent from west to east, the chief principles of weather forecasting will have been mastered.

During this year's work map reading should be a frequent exercise, and for this purpose the maps published by the United States Geological Survey should be employed.[1] Inasmuch as the contour map is unquestionably the map of the future, there is no better place than the school in which to learn how to interpret its meaning. For the critical study of these maps a dozen or more sheets should be provided, including, if possible, areas with which the pupils are familiar. It is hardly necessary to add that such map study is not designed as an aid to memory work; it is intended solely for the purpose of enabling the pupil to read from a conventionalized form the various features of drainage, climate, and surface conditions. In discussing the commercial products of a region, the plan of graphic charting mentioned in Chapter IX will be found almost indispensable, and should be employed wherever possible. Thus a comparative study of the western limit of wheat and cotton, with the rainfall and population maps, brings out mutual relations that otherwise would hardly be apparent.

Comparative values expressed by diagrams appeal more strongly to the mind than do expressions in

[1] A complete catalogue of the sheets engraved up to the present time can be obtained on application.

figures; they have a very decided educative value, moreover, when the diagrams are constructed by the pupils. The mere fact that the pupil constructs them, imparts to them a staying quality in the mind they could not otherwise acquire. In the study of the topography of a region it is often essential to consult a profile of the region in question. With a contour map in possession this is a very easy matter, for each contour represents a definite elevation; therefore by laying off the horizontal scale in miles, and the vertical scale in feet, it is a matter of only two or three minutes to make the profile. One may, of course, study ready-made profiles, but their value is largely in the effort of the pupil, and not that of some one else. In work of this kind it is, of course, necessary to remember one's own neighborhood; the study of geography, like charity, begins at home.

A more interesting matter is study of the products of a region with reference to their geographic environment. There are always instances of products that will "pay" in one locality, but not in another; and quite frequently the reason therefor is geographic. For instance, wheat growing is financially successful in Minnesota, but not in Connecticut. Sugar-cane and cotton can be grown in Louisiana, but not in Montana. In fact, one may take the entire list of products, and in each case the area of production is restricted. In most instances the restricting barriers are geographic, and the inves-

tigation of the operating causes is a most practical study.

A study of the topographic features of town, county, or state, with reference to their bearing on the activities of life, will be a highly instructive line of investigation. Thus, a mountain range may yield mineral and metallic products; it may afford grazing, and therefore be a stock range; it may be an impassable barrier that prevents free intercommunication. An intermontane valley may be fertile, and therefore densely peopled, or it may be deficient in soil and sparsely settled; in either case the problem to be solved is contained in the question — Why? If the topographic feature is a pass or "railroad gap," the problem will involve an investigation, not only of the products that are shipped through it, but whence they come and whither they go. So, too, a river may be a navigable highway of commerce; it may be a torrential stream that furnishes water power; it may have a broad cultivable flood plain, or it may have an estuary that forms a harbor for foreign commerce; obviously the proper thing is the study of the stream from a utilitarian aspect, and when this is done, it will be apparent that the utilitarian side is based upon principles that are strictly geographic.

The suggestions in the foregoing pages of this chapter are not offered as a course of study; but the teacher will find therein the material for supplement-

ing the prescribed book work, and also for rounding out and enriching any course. Necessary as the observational, laboratory, and field work may be, it cannot take the place of a certain amount of book study and general reading. No scholar, however broad and comprehensive his learning, can acquire all his information by observation; from the very nature of the case one must get the greater part by reading or by methods that are second hand.

CHAPTER XII

THE TEACHER'S PREPARATION

THE most difficult task that confronts the grade teacher of geography is the matter of preparation for teaching the subject. The old methods of instruction that involved but little more than a moderate familiarity with map questions and locations is rapidly becoming a thing of the past. In a few localities this sort of thing still obtains for the reason that the only end to which education applies is the ability to pass the compulsory examinations; and there are likewise other places in which public sentiment is indifferent, or perhaps not educated to the difference between good and poor teaching. Throughout a very large part of the country, especially west of the Appalachian Mountains, geography teaching is in a condition of rapid evolution, and the ideas concerning the knowledge that is best are undergoing a very positive crystallization. That the teacher of to-day demands a broader and a better equipment than ever before goes without saying. Let us note some of the essentials.

First of all, one should possess general knowledge of the peoples of other parts of the world and the

countries in which they live. This much is expected of every intelligent person. In the main, this knowledge must be acquired by reading; but if the teacher can spend even a single vacation among foreign peoples, in a foreign land, the help will be very great, and of the most practical kind. It will put a life and meaning into the knowledge acquired by reading that cannot possibly be gained otherwise. In the study of peoples and countries it is imperative that the teacher shall have a broader acquaintance with the literature of travel than that afforded by the text-book itself. For this purpose several of the recent text-books in geography contain excellent lists of collateral reading. In general, however, the teacher should depend upon the needs of the case and the exercise of judgment in the selection of such reading. Certainly, it should be broader and more exhaustive than that suggested for pupils' work. One must bear in mind, however, that the ability to see the world through the child's eyes is a very necessary achievement; perhaps this faculty may be a gift, but it is also one that can be acquired. In other words, one part of the teacher's preparation is to take such material as may be available and put it into the form that can best be assimilated by the pupils.

In the second place, the teacher must become familiar with physiographic processes and the agents that are responsible for them. To this end a course

in laboratory and field work is imperative, and there must be plenty of it. One must bear in mind that a mere sight acquaintance with a topographic form is not physiography. The neighborhood accessible may not present a great variety of topographic forms, but there are few localities in which illustrations of physiographic processes are not abundant. About every variety of erosion, corrasion, transportation, and deposition may be found on a rainy day within a radius of half a mile of the schoolhouse.

Not only should the physiographic processes and their agents be observed, but their results as shown in rock formations ought also to be studied. Most likely the material of this part of the work will not be abundant, and if not one must depend for the rest on reading in order to get the necessary information. All this is right and proper, provided that one does not lean wholly on reading in order to get the information. In the experience of life people must deal, not with verbal or written descriptions, but with things; it is therefore the objective rather than the descriptive side of geography that should be strongly emphasized. The latter has a definite place, it is true, but the place should be most decidedly a secondary one

The field work should be that of the neighborhood, and should include a pretty close study of all the forms and processes that appear to have given it shape.

A good working knowledge of the physical geography of the neighborhood is necessary in two ways. Not only must the teacher draw upon it for illustrations required in the class room, but it is highly necessary in mastering the general principles of geography. For instance, a student may have become thoroughly acquainted with the illustration of some physiographic feature or process without knowing much about the general principles involved; but when the latter are investigated in their broadest relation, the student has the mental picture of the illustration already at hand. Moreover, it often happens that the actual field investigation of one form or process renders the descriptive study of another quite as easy to comprehend as would be the actual field study of it.

The prescribed course in nature study will furnish many hints concerning the observational work, and therefore the teacher should become not only familiar, but expert, in everything the teaching of which is a part of the course of study in geography. Certainly not every geographic form or feature mentioned in the prescribed course is within the reach of the student, but the judicious use of pictures, photographs, and models, all of which are now available, will give a very clear idea of the actual feature. It is well to keep in mind that the modern photograph or halftone may be used as something more than a picture to admire; it may be made a very effective laboratory study.

The third and most important aspect of the teacher's preparation involves the interrelation of the customs, employments, and political institutions of a people with their geographic environment. This information is not always easy to obtain, and for the greater part it must be acquired by reading. Unfortunately there is no treatise on the subject available for the purpose of technical study, and the material that is useful must be sought here and there in chapters and volumes, the greater part of which have no specific bearing on geography. For this reason it is almost impossible to arrange a good course of reading on the subject of economic geography, and the student who is not within reach of a good library, to a great extent is shut off from such a course. Granted that the charge of very poor geography teaching which has been made against the teachers of the United States is true, there is good cause for such a condition. There are more than half a million teachers in the country, nearly all of whom are required to have some knowledge of the subject, and to fit this number there are special courses in two or three universities and about a dozen normal schools. A considerable help should be expected of the army of normal schools, but unfortunately many of them are too completely wedded to the flesh-pots of method to accomplish what is most needed; namely, some good academic work in the general principles of geography.

PHYSIOGRAPHIC GEOGRAPHY

To the student who has undertaken the requisite field and laboratory work the following supplementary reading or its equivalent is recommended. It is not necessary to purchase an extensive list of books, but one or two manuals and at least one comprehensive reference book is necessary. It is essential that the student shall possess a general knowledge of the fundamental principles of physical geography, and for this purpose either one of the three recent text-books on the subject may be used profitably; namely, Tarr's (*Macmillan Company*), Davis's (*Ginn & Company*), or Redway's (*Charles Scribner's Sons*). These texts differ from the earlier publications in containing the *physiographic* aspect of geography; that is, in addition to the description of a physical feature its origin, evolution, and destruction are set forth. The text used may be supplemented by Mill's "Realm of Nature" (*Charles Scribner's Sons*) or by Geikie's "Physical Geography" (*Macmillan Company*).

Among the older text-books there are noteworthy chapters with which it is well to be familiar. In Appleton's "Physical Geography" (*American Book Company*) the chapter entitled "Mineral Products and their Distribution," p. 114 *et seq.*, is one of the best to be found in any educational publication.

The succeeding chapter, "Physical Features of the

United States (Gannett, *U. S. Geol. Survey*), is also worth a close study. Chapter XVII, Monteith's "New Physical Geography" (*American Book Company*), contains a very elementary, but a most excellent, study of cyclonic storms. Its chief merit is its simplicity and clearness. Maury's "Physical Geography" (*University Publishing Company*), p. 61, contains a very full text on ocean currents and their distribution. In Warren's "New Physical Geography" (*Butler-Sheldon Company*), pp. 100–116, is an exceedingly instructive chapter on the distribution of life. In Redway's "Manual" (*D. C. Heath & Company*), Chapters VII, VIII, and IX, will be found a discussion on ordinary misconceptions of geographic forms.

All the foregoing, however, are elementary, and their value is mainly from the pedagogical standpoint. For professional training one of the best as well as the most practical of treatises is Le Conte's "Elements of Geology" (*D. Appleton & Company*). Part I is a very thorough treatise on physiographic geography (containing nothing on meteorology). Part II is a technical consideration of rock structure. It would better be preceded by a more elementary work like that in Shaler's First "Book in Geology" (*D. C. Heath & Company*), pp. 233–252, or Tarr's "Economic Geology," pp. 33–103. Part III treats of historic and stratigraphic geology. The whole book is written in most interesting and charming style; it is very broad in

treatment and of great educational value. It is more useful as a book for systematic study than the more comprehensive treatises of Dana (*American Book Company*) or Geikie (*Macmillan Company*), but it cannot replace these as reference books.

Dana's "Geology" (4th edition) is an exhaustive treatise, and is strictly technical in character. The parts embraced in pp. 89–396 and pp. 932–1036 will be found worthy of repeated study. Geikie's "Geology" (3d edition) is similar in scope to the foregoing, and although an English publication, is very full in all matters pertaining to the geology and physiographic features of the United States. Books I–IV cover about the same subjects as the first four hundred pages of Dana. A comparative study of the two is suggested. Book VII is a highly instructive résumé of the general principles of physiographic geography. The illustration page 1084 will be found a most entertaining object lesson. The indices of these two books are a great convenience to any reader; there is hardly a name connected with the science of geology that cannot be found in either one.

The publications of the United States Geological Survey contain a vast storehouse of practical information, both as to principles, and also their application. Powell's "Exploration of the Colorado River of the West" (*U. S. Geol. Survey*, 1875) has, in addition to the narrative of exploration, a treatise on the morphology of

montane valleys (Chapters XI–XII) that is a standard at the present time. Gilbert's "Lake Bonneville" (*U. S. Geol. Survey*, Mon. I), Chapter II, contains about the best treatise on the morphology and topography of shore lines that is available to students. This monograph contains a discussion on the deformation of the earth's surface resulting from the desiccation of Lake Bonneville. The monograph should be studied as a whole, however, rather than as a series of essays. Gulliver's "Shoreline Topography" (*Am. Journal of Science*, Jan. 1899) is also a very helpful essay on coast morphology. Russell's "Lake Lahontan" (*U. S. Geol. Survey*, Mon. XI) and his "Lakes of North America" (*Ginn & Company*) constitute a most excellent treatise on the origin and life history of lakes. "Physiography of the United States" (*American Book Company*) consists of a series of monographs prepared by members of the United States Geological Survey, especially for the teachers of the United States. Every chapter in the book ought to be familiar to the teacher of geography.

The maps published by the Geological Survey are the best extant. They are highly conventionalized, and therefore enable one to read and interpret the physical geography of the region.[1]

It is necessary to have at least a theoretical acquaintance with the various methods of constructing and projecting maps; for this purpose the teacher is

[1] For information concerning these, see Chapter IX.

referred to Elderton's "Map Drawing" (*Macmillan Company*) or to Redway's "Reproduction of Geographic Forms" (*D. C. Heath & Company*).

ROCKS AND MINERALS

Rocks and minerals must be studied objectively, and the teacher must expect to provide himself with at least a few specimens. To become familiar with the minerals noted in Chapter XI is essential. In addition it is advisable to procure the following, which are mainly of the class of igneous rocks: rhyolite, trachyte, porphyry, felsite, granites (various specimens that will show one or more of mica, feldspar, quartz, hornblende, garnet, and tourmaline), gabbros (including specimens showing olivine and augite), andesite, diabase, asbestos, and labradorite. One may learn to determine these fairly well by their external appearance, and this knowledge is about all that will ever be required of the grade teacher.

The following minerals, some of which are listed in Chapter XI, should also be studied until their physical characteristics are familiar: talc, hornblende, pyrites (both iron and copper), graphite, gypsum, garnet, the various carbonates of lime, the various feldspars, and the various forms of quartz (chalcedony, amethyst, carnelian, agate, etc.), and such others as may occur in the neighborhood.

With reference to sedimentary rocks, it is essential

that one must be familiar with the general classes, such as sandstone, conglomerate, shale (and slate), clay, and also such forms as alluvium, silt, loess, till, etc. A good description of these occurs in Dana's "Geology" (4th edition, pp. 80–81); they must be familiarized, however, not by reading, but by observation. In general, the best line of study and investigation will be afforded. For the preparation in geography, blowpipe and chemical determinations are not essential, but they are to be recommended. Specimens that cannot be readily determined should be sent to the nearest available authority — the geological department of the state university or the United States Geological Survey. This applies especially to the rocks and minerals of the neighborhood.

METEOROLOGY AND WEATHER STUDY

In addition to the chapters on this subject presented in the text-books of physical geography, a considerable laboratory work and technical study are necessary. The laboratory work should consist of the manipulation and use of the thermometer, barometer, and rain gauge; the observational study of clouds, winds, and storm movements, etc; and also the study of weather maps and the making of forecasts.

In the matter of theoretical study there is a choice between two excellent manuals, Waldo's "Meteorology"

(*American Book Company*) and the more advanced Davis's "Meteorology" (*Ginn & Company.*) Ward's "Exercises in Meteorology" (*Ginn & Company*) is the most helpful manual yet published on weather forecasts. For the general study of weather conditions in the United States, Greely's "American Weather" (*Dodd, Mead & Company*) is not only a comprehensive monogram on the subject, but a very interesting book as well. One must bear in mind that though a certain amount of reading is necessary, the knowledge that gives strength must come from observational work. Certainly no side of geography is more practical than this.

For definite instructions in making the usual weather observations it will be better to consult the instructions issued officially to the forecasters of the United States Weather Bureau. In carrying on systematic observations a thermometer, a barometer, and a rain gauge are indispensable, and a serviceable set may be procured for six dollars.[1] For the technical study of weather forecasting one cannot do better than to procure the *National Geographic Magazine*, Vol. VIII, No. 3. Twenty-five full-page maps are employed to illustrate the subject, and these cover about every weather condition.

[1] This is the minimum; it would be better to have a maximum and a minimum thermometer, which will bring the cost to about eight dollars. A hygrometer is convenient but not essential.

POLITICAL AND DESCRIPTIVE GEOGRAPHY

Extensive travel falls to the lot of but few people, and for the greater part one's knowledge of the world must be obtained by reading. There are so many books of travel that an analysis of any of them would be impracticable. One class, however, should be avoided; namely, those written by the enterprising globe-trotter who spends three weeks in Asia, two in Africa, and one in South America, and then publishes his "impressions" in ten volumes. There are a few tourist books, however, that have a decided value from an educative standpoint, such, for instance, as Knox's "Boy Travellers" and Abbott's "Rollo Books"—long since having a very definite place among the books of juvenile literature. For the teacher, reading of a different character is required, and it must be authoritative.

The various cyclopædias to which many have access contain a vast amount of information, but inasmuch as the statistics of geography are constantly changing, too much confidence should not be placed upon them in this respect. For statistical geography no other publications can compare with "The Statesman's Year Book" (*Macmillan Company*) and the "Almanach de Gotha." The latter is published in German and French; the former, a volume of about 1200 pages, is a statistical geography of the world, and is invalu-

able for purposes of reference. Under ordinary circumstances it is sufficiently accurate after a lapse of two or three years.

Stanford's "Compendium of Geography" (*Stanford*) is a comprehensive publication in six parts of eleven volumes. The text is diffuse in style, and both interesting and accurate. Keith Johnston's "London Geography" (*Stanford*) is an excellent, comprehensive treatise leaning somewhat toward the historical side of the subject. One of the very best works that has yet appeared is "The International Geography" (*D. Appleton & Company*); it is the work of about seventy specialists, edited by Hugh Robert Mill, formerly Librarian of the Royal Geographical Society. The contents, arrangement, and style all make the book highly adaptable to the teacher, not only as a preparation for the work of geography teaching, but in class-room work as well.

Much valuable material may be obtained from such publications as the *Scientific American*, the Sunday supplements of the *New York Sun*,[1] the *Literary Digest*, the magazines, and similar publications. Clippings from newspapers should be arranged topically in one or more scrap-books; magazine articles may

[1] The Sunday edition of the *Sun* in one year contains about as much good geographic reading as the best of the professional publications devoted to the subject, and, as a rule, the articles are infinitely more readable.

be stitched and bound in volumes of convenient size. Literature of this kind, if selected with a view to future reference, constantly grows in value.

The *National Geographic Magazine* (*McClure, Phillips & Company*), the official organ of the National Geographic Society, contains a great deal of information for the geography teacher. The articles are from specialists, and many of them are written directly to teachers and pupils. The *Scottish Geographical Magazine* has also much that is useful to both teachers and students of geography. In addition to the foregoing are two geographical publications intended especially for the preparation of teachers. The *Journal of School Geography* is conducted by Professor R. E. Dodge, Teachers College, New York City. Its literature is practical and scholarly. The *Bulletin of the American Bureau of Geography*, the official organ of the Bureau, contains considerable matter in the way of descriptive geography. The Bureau is conducted by Mr. Edward Lehnerts, formerly Professor of Geography in the State Normal School at Winona. Its object is a very practical and admirable one; namely, the supply and exchange of lantern slides, photographs, and all sorts of material required by the geography teacher.

The supplemental reading intended primarily for pupils will be of material aid also to the teacher. Miss Smith's "World and its People" (*Silver, Bur-*

dett & Company), Mr. Rupert's Reader (*Shewell*), and Mr. Carpenter's well-known books (*American Book Company*), present a side of life in foreign lands that is rarely to be found in the more pretentious books of travel, and Mr. Vincent's "Actual Africa" (*D. Appleton & Company*) will furnish excellent reading concerning that continent.

ECONOMIC AND HISTORIC GEOGRAPHY

Whatever knowledge is obtained along the lines of economic or "commercial" geography must be acquired mainly by reading, and for the latter one must be willing to spend a great deal of time in order to obtain a very little in the way of return. There are a few books that treat of the geography of commercial products, such as Chisholm's (*Longmans, Green & Company*), the elementary manual of Mr. H. R. Mill (for grammar schools), and that of Mr. E. C. K. Gonner (*Macmillan Company*). These are books that deserve a place in the library of every teacher. For the study of the interrelation of geography, history, and commerce, perhaps the most practical treatise yet published is Mr. John Fiske's "Discovery of America" (*Houghton, Mifflin & Company*). Although intended as a historical work, the geographer and the political economist will each find it a most useful handbook for reference. It reads like a romance, and in its line it is unquestionably the most important historical

production of the nineteenth century. Chapters II and IV of this book touch briefly on this aspect of geography. Shaler's "Nature and Man in North America" (*Charles Scribner's Sons*) is helpful and suggestive along this line, and so also is Trotter's "Lessons in the New Geography" (*D. C. Heath & Company*), a special feature of which is the effect of climate and topography on the distribution of mankind.

The student of geography cannot do better than to take each geographic feature or agent, such as mountains, valleys, plateaus, passes, plains, rivers, glaciers, winds, ocean currents, and discover its effects or influence on history, economic relations, and social life. Conversely it will be well to study each great physical region in order to learn why and in what manner its industrial and social features are what they are. Much is said about the correlation of geography and history nowadays, and, indeed, one might as well endeavor to divorce water and the quality of wetness as to separate these two studies one from the other. Each, however, has a distinct aspect; the one is cause, the other is effect.

A certain amount of local work may be taken up also. Every neighborhood or region has its own industries, and they are there in all probability for one or more of the following reasons: suitable topography, suitable climate, the local production of a material that is not

produced elsewhere, easy and cheap transportation, and the concentration of labor skilled in that particular pursuit.

Unfortunately no handbook on the correlation of geography, history, and economics has yet appeared, in which these principles are applied definitely to the United States. The student must therefore grope about and do a great deal of desultory reading in order to obtain a very little information. One must bear in mind, however, that this aspect of geography is its most important feature. Knowledge in the abstract is certainly educative, but the ability to apply knowledge is wisdom; and the full perception of the various ways in which geographic environment influences our lives and activities is the foundation of statesmanship.

The list at the end of this chapter is not intended to be comprehensive, and many books of the highest class are omitted. Those named, for the greater part, will be found in the lists of the various Reading Circles; others may be obtained in most of the public libraries. It is not even suggested that any great number be purchased. As a matter of fact, the number of books actually required, in connection with the field and laboratory work, is surprisingly small. If the teacher is the right sort of stuff, the following list will prove an equipment that mastered will put one in the foremost rank of geography teachers.

Any modern text-book of physical geography	$1.25
Le Conte's "Elements of Geology"	4.00
Waldo's or Davis's "Meteorology," 90¢ or	2.50
Fiske's "Discovery of America"	4.00
Ward's Exercises in Meteorology	1.25
"International Geography"	3.50
Elderton's or Redway's "Map Drawing"	.30
	$16.80

To this may be added any good reference atlas, and as these range from $1 to $30 there is a wide choice. A good reference atlas should have a complete index of names, in order to be of practical use. Moreover, one must supplement even the most complete atlas with maps of the "unexpected," that is, with those changes that result from discovery, from disturbed political conditions, and from causes that cannot be foreseen. Information of this character, accompanied by sketch maps, is always to be found in the better class of newspapers and magazines, and a scrap-book of such maps should be kept with the atlas.

That the teaching of geography should be placed on a materially higher plane is no longer a question for discussion: it is one to which public sentiment has already returned a decisive answer. Moreover, the army of teachers are beginning to realize that, for the greater part, they must train themselves, and they are already setting about the accomplishment of the self-imposed task. As Professor Geikie says: "So vast is the field of inquiry and so vague the boundaries of the

subject, one can hardly discover where to begin, or having begun, choose out of the overwhelming multiplicity of detail the parts which are really of service for geographical purposes."

In the preceding paragraphs of this chapter, the author has endeavored to clear a way through the vast field of somewhat uncertain boundaries. The thoughts offered are suggestions rather than minute directions; to follow them slavishly, therefore, will not be advisable. The individuality of a strong teacher counts quite as much as scholarship, and the student of these chapters should not hesitate to go to the right or the left as judgment dictates. To the great army of rural and grade teachers, one of whom the author has been, these chapters are addressed by a fellowcraftsman, and if they stimulate to better work in the future, then their purpose will have been fulfilled.

BOOKS OF REFERENCE PERTAINING TO GEOGRAPHY

METHOD

Geikie. The Teaching of Geography. Macmillan Co. \$0.65.[1]
Farnham. Oswego Methods in Geography. Bardeen.
Frye. Child and Nature. Ginn & Co. \$0.75.
Jackman. Field Work and Nature Study. Flanagan.
King. Methods and Aids in Geography. Houghton, Mifflin & Co. \$1.15.
Parker. How to Study Geography. D. Appleton & Co. \$1.10 and \$0.15.
Mill. Choice of Books for Reference. Longmans, Green & Co. \$0.94.
McMurry. Special Method in Geography. Public School Publishing Company.
Redway. Teacher's Manual of Geography. D. C. Heath & Co. \$0.50.
Redway. Reproduction of Geographic Forms (Map Drawing and Modelling). D. C. Heath & Co. \$0.30.
Nichols. Topics in Geography. D. C. Heath & Co. \$0.60.

PHYSICAL GEOGRAPHY, METEOROLOGY, GEOLOGY

Le Conte. Elements of Geology. D. Appleton & Co. \$4.00.
Geikie. Text-Book of Geology. Macmillan Co. \$7.50.
Dana. Manual of Geology. American Book Co.
Waldo. Elementary Meteorology. American Book Co. \$0.90.
Davis. Elementary Meteorology. Ginn & Co. \$2.30.
Ward. Exercises in Practical Meteorology. Ginn & Co.

[1] The prices given are taken from catalogues of 1900–01. In some instances cheaper editions may be procured. Postage may be reckoned at about fifteen cents on the dollar.

Trotter. Lessons in the New Geography. D. C. Heath & Co. $0.90.

Shaler. Aspects of the Earth. Chas. Scribner's Sons. $1.75.

Shaler. Sea and Land. Chas. Scribner's Sons. $1.75.

Shaler. Nature and Man in North America. Chas. Scribner's Sons. $1.05.

Mill. The Realm of Nature. Chas. Scribner's Sons. $1.15.

Roberts. The Earth's History. Chas. Scribner's Sons. $1.15.

Physiography of the United States (ten monographs). American Book Co. $2.50.

Russell. Lakes of North America. Ginn & Co. $1.40.

Russell. Glaciers of North America. Ginn & Co. $1.65.

Russell. Volcanoes of North America. Ginn & Co. $3.00.

Wallace. Island Life. Macmillan Co. $1.30.

Wallace. Geographical Distribution of Animals. Harper Brothers. $7.00.

Tyndall. Forms of Water. D. Appleton & Co.

Green. (Catalogue.) Manufacturer of Weather Instruments for United States Weather Bureau. 1191 Bedford Ave., Brooklyn, N. Y.

DESCRIPTIVE AND POLITICAL GEOGRAPHY

Keltie. Statesman's Year Book. Macmillan Co. $3.00.

Johnston. Geography, Descriptive, Physical, and Historical. Stanford. $3.00.

Mill. International Geography. D. Appleton & Co. $3.00.

Stanford's Compendium of Travel —

- **Rudler and Chisholm.** Europe. (2 vols.) $7.65.
- **Keane.** Asia. (2 vols.) $7.65.
- **Keith Johnston.** Africa. (2 vols.) $7.65.
- **Hayden and Selwyn.** North America. $3.85.
- **Bates.** South America, Central America, and West Indies. $7.15.
- **Wallace.** Australia. (2 vols.) $7.15.

Vincent. Actual Africa. D. Appleton & Co. $3.00.

Marco Polo's Travels. (Translated by Marsden.) Macmillan Co. $1.50.

Century Atlas. Century Publishing Co.

HISTORIC, ECONOMIC, AND COMMERCIAL

Gonner. Commercial Geography. Macmillan Co. $0.55.

Mill. Commercial Geography. Macmillan Co.

Chisholm. Handbook of Commercial Geography. Longmans, Green & Co. $3.00.

Fiske. Discovery of America. (2 vols.) Houghton, Mifflin & Co. $4.00.

Shaler. Nature and Man in North America. Chas. Scribner's Sons.

Trotter. Lessons from the New Geography. D. C. Heath & Co. $0.90.